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BALDACCI (E.) & BORZINI (G.). **Il mal degli sclerozi nei Fagioli.** [The sclerotial disease of Beans.]—*Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV, pp. 69–86, 8 figs., 1933.

In 1932, beans [*Phaseolus vulgaris*] growing in the province of Pavia were slightly attacked just before harvesting by *Sclerotinia libertiana* [*S. sclerotiorum*]. A year later the disease reappeared on the young crop, killing many plants and necessitating resowing. The second lot of seedlings grew well until June, when a fresh attack caused considerable losses in damp places and where the plants were overcrowded. A full description of the symptoms of the disease is given, together with a summary of previous records in other countries and an account of the life-history of the fungus. The Fagiolo del Papa variety remained unaffected, while Borlotto di Vigevano was highly susceptible and Varese moderately so. The seeds of the affected plants showed reddish-brown lesions, but when infected seed was sown in reasonably dry soil and the weather during the growing period remained dry the resultant plants were healthy. It is considered that the attack in 1933 was greatly favoured by rainy weather, supplemented by inadequate drainage and excessive applications of organic fertilizers. Infection comes mainly from the sclerotia in the soil and requires soil and weather conditions favourable to their germination and growth. Inoculations in the laboratory gave positive results only on wounded pods, though healthy pods mixed with diseased ones developed characteristic sclerotia. Inoculations into the stems gave negative results. The paper terminates with brief practical notes on control, and there is a bibliography of 34 titles.

KORNFELD (A.). **Die Blattfleckenkrankheit der Soja—eine Kalimangel-Erscheinung.** [Leaf spot disease of Soy-Bean—a potash deficiency phenomenon.]—*Zeitschr. für Pflanzenernährung, Düngung und Bodenkunde*, xxxii, 3-4, pp. 201–221, 6 figs., 1 graph, 1933.

Since 1930 the writer has been investigating a leaf-spot disease of the extensive soy-bean crops in Transylvania, Rumania. The external symptoms of the disorder, which is attributed to potash deficiency, include an irregular spotting and sometimes chlorosis of the foliage and precocious maturity with its concomitants of defoliation and reduction in the quantity and quality of the yield. Among the internal modifications are starch accumulations and

a feeble development of the bast of the stem, with consequent tendency to lodging. Germinative capacity and energy are reduced in the seed from affected plants, and the latter are liable to attack by *Bacterium phaseoli sojense* and *Bact. glycineum* [*R.A.M.*, v, p. 723 *et passim*].

DECOUX (L.), VAN DER WAEREN (J.), & ROLAND (G.). **La végétation de la Betterave en Belgique au cours de l'année 1932.** [The vegetation of the Beetroot in Belgium during the year 1932.]—*Publ. Inst. Belge pour l'Amélior. de la Betterave, 1933*, 6, pp. 267–284, 6 graphs, 1933.

During the warm, damp summer of 1932 fungous diseases of beets are stated to have been more prevalent in Belgium than at any time since 1915. *Phoma betae* caused heavy damage, not only in the form of 'black leg' on seedlings, but also as an agent of 'heart rot' of fodder beets [*R.A.M.*, ix, p. 152; xii, p. 2], the roots of which in a field at Jauche with alkaline soil reaction were quite hollowed out by the fungus, 70 per cent. of the crop being attacked over an area of 2 hect. Other root parasites included *Rhizoctonia violacea* [*Helicobasidium purpureum*: ibid., x, p. 434], *Bacillus bussei* [ibid., vi, p. 147], one of the agents of gummosis, and *Bacterium tumefaciens*.

Leaf spot (*Cercospora beticola*) occurred in a virulent form, destroying up to 85 or 90 per cent. of the leaves in severe cases, especially in the Hesbaye district. Ordinarily this disease is of little importance in Belgium, and according to E. Marchal [ibid., xii, p. 676] there is no need for alarm since the extraordinary weather conditions promoting the epidemic are unlikely to recur frequently. Other fungi recorded on the leaves but causing relatively little injury were *Sporodesmium putrefaciens* [ibid., xiii, p. 10], *Uromyces betae*, *Ramularia betae*, and *Phyllosticta betae*.

VERPLANCKE (G.). **Les viroses de la Betterave.** [The viruses of Beetroot.]—*La Sucrerie Belge*, liii, 1, pp. 2–10; 2, pp. 22–32, 7 figs., 1 graph, 1933. [Flemish summary.]

Mosaic and yellows are stated to be the two virus diseases affecting beets in Belgium [*R.A.M.*, ix, pp. 355–6]. Four types of the former, with which the writer is mainly occupied, may be distinguished, viz., speckled, veined, marbled, and pocked (following Merkel's classification of mosaic types in the Papilionaceae) [ibid., ix, p. 121]. Cytological studies of diseased material [ibid., xii, p. 263] revealed hypoplasia of the leaf tissues; reduction of nuclear diameter in the mottled areas; expansion of the plastids which may amalgamate and undergo fatty degeneration; the presence in the mesophyll of 'X bodies', resulting from aggregation of the leucoplasts; and necrosis of the phloem, the cells of which show a thickening of the walls and contain a yellow deposit, extending to the roots in which X bodies are found in the cortical parenchyma.

Transmission was effected in 100 per cent. of the writer's tests by smearing the expressed juice of mosaic leaves on wounded healthy ones; the insects *Doralys fabae*, *Myzus persicae*, and *Aulacorthum pelargonii* gave positive results in 71 to 89 per cent. of the experiments in transmission by them. No sign of 'masking'

of the symptoms was observed, although the test plants were held at temperatures exceeding 25° C.

In the writer's experiments the disease appeared in 7·1 per cent. of the plants raised from seed from mosaic mother beets; this is in agreement with Ducomet's results [ibid., vii, p. 418]. Yellows was found to be similarly transmissible to the extent of 5·7 per cent. No transmission of infection takes place through the soil, even when roots of diseased and healthy plants are in close contact; it was readily effected, however, by grafting fragments of mosaic on to healthy roots.

Forty-five species of weeds in 22 families were found to harbour the mosaic virus, while that of yellows was detected in 32 species in 19 families. Neither attenuation nor increase in virulence accompanied its passage from beets to weeds and back again. Cytological studies of mosaic material of turnip, *Rumex crispus*, chicory [*Cichorium intybus*], carrot, and broad bean [*Vicia faba*] showed the same features as those described for beet; transmission was effected to the last-named from all except *V. faba*. Field experiments indicated that beet mosaic is favoured by the use of nitrogenous fertilizers. None of the 20 sugar beet varieties under the writer's observation showed an appreciable degree of resistance to the disease, which was found to cause a considerable reduction in the sugar content of the roots.

WANTUCHOWSKI (J.). **Cercospora beticola: its influence on Beet experimentation and breeding.**—*Facts about Sugar*, xxviii, 12, pp. 455–457, 1933.

The results [which are tabulated and discussed] of experiments at the Gorka Narodowa Seed Breeding Station, Warsaw, on varietal reaction to leaf spot of beets (*Cercospora beticola*) [*R.A.M.*, xi, p. 20] showed the necessity of using a healthy standard variety for comparative purposes. Of the 240 varieties tested at the Breeding Station in 1931, 101 resisted infection better than the standard, 33 were equal to the latter in this respect, while 106 fell more or less below the standard.

GOE. **Bekämpfung der Zwiebelrotzkrankheit.** [Control of the Onion slime disease.]—*Obst- und Gemüsebau*, lxxix, 11, p. 174, 1933.

The Aschersleben [Saxony] branch of the Biological Institute is engaged on a study of the 'slime' disease of onions [*R.A.M.*, xiii, p. 5], which is particularly injurious to the second-year seed bearers. The leaves turn pale and show yellow stripes, become crinkled and limp, and finally droop down to the ground. Pending the detection of a causal organism [ibid., x, p. 329], the following are the only practicable control measures: procurement of seed from an unaffected locality; winter forcing of seed samples to ascertain the incidence of infection; choice of small bulbs; and dense planting to avoid exposure to the light.

CORBETT (W.). **Asparagus rust.**—*Fruit-Grower*, lxxvi, 1981, pp. 941–942, 1933.

The hot summer of 1933 apparently favoured a recrudescence

of asparagus rust [*Puccinia asparagi*: *R.A.M.*, xii, p. 745] in many parts of England. The disease appears to have been last recorded in England in 1897, but inquiries showed that it occurred in the Evesham district in 1899 and was severe there in 1904–6, inclusive, while one case was observed in Cambridgeshire in 1912 and another a few years ago. The symptoms of the disease are briefly described in popular terms, with a recommendation for the arrest of further attacks by one or more applications to the 'bower' of very finely divided sulphur dust at the rate of ½ cwt. per acre.

YU (T. F.). **Pathological and physiological effects of Bacillus tracheiphilus E. F. Smith on species of Cucurbitaceae.**—*Nanking Coll. of Agric. & Forestry Bull.* 5 (New Series), 72 pp., 10 pl., 3 graphs, 1933.

A comprehensive, fully tabulated account is given of the writer's studies, at Nanking, China, covering a period of three years, on the physiology of *Bacillus tracheiphilus* [*R.A.M.*, xi, p. 428], the process of wilting in cucumbers associated with its presence, and varietal reaction to the organism amongst the Cucurbitaceae.

B. tracheiphilus was found to be capable of utilizing dextrose, levulose, galactose, mannose, mannite, lactose, sucrose, raffinose, glycerine, dextrin, inulin, and starch, with the production of acid but no gas. It was unable to use nitrogen from inorganic nitrogenous compounds or from several amino-acids. In beef bouillon it grew best between P_H 6·75 and 7·6 at 28° C., but was short-lived. The organism, which enters the host (Chinese Long cucumbers in these experiments) through the spiral vessels in wound infections, migrates from one vascular bundle to another at the sites of anastomoses at the union of midrib and petiole and in the nodes. The daily transpiration rate was found to decrease with the progress of wilting in the plants, the development of which is assigned in part to physiological changes accompanying the dissolution of the xylem tissue by the bacteria, and in part to the plugging of the vessels. No toxic action could be determined.

Inoculation experiments on 119 varieties or selections of cucumbers, 111 of cantaloupe, 21 of squashes (*Cucurbita moschata* and *C. maxima*), and 16 of vegetable marrow (*C. pepo*) showed that these plants are susceptible to *B. tracheiphilus* in the order named, the American varieties being generally more resistant than the Oriental ones. Under field conditions, however, these positions were largely reversed, presumably owing to the preference of the beetles *Diabrotica vittata* and *D. duodecimpunctata*, which aid in its dissemination [ibid., i, p. 327; x, p. 500], for the American varieties.

BROWN (J. G.) & EVANS (M. M.). **A Phytophthora rot of Watermelon.**—*Arizona Agric. Exper. Stat. Tech. Bull.* 51, pp. 45–64, 4 pl., 1933.

Iowa Belle watermelons in the vicinity of Tucson, Arizona, were attacked in 1932 by a rot confined to the fruits and characterized at first by brown specks, 2 to 4 mm. in diameter, enlarging to form alternate brown and pale concentric rings, surrounded in the late stages by a rather light pinkish-buff, downy band consisting of the

conidiophores and conidia of a species of *Phytophthora*, outside which there is finally a ring of a dark ivy-green to blister-brown colour. The expansion of the spots was sometimes accompanied by cracking of the centres, while the internal tissues developed a soggy, water-soaked consistency coinciding with the advance of the fungus in the fruit tissues which was found to occur at the rate of 107 mm. in ten days. No resistance to infection was shown by any of the tissues.

The conidiophores and sporangiophores of the fungus, which was isolated from the diseased melons and grew well on a medium of autoclaved mixed grains, are simple on the host but loosely branched in culture. The typically citriform conidia, with or without a papilla, measure on an average 37·2 by 23·9 μ and may either liberate zoospores (sometimes into a vesicle) or germinate by one or more germ-tubes. Two types of sphaeroconidia [ibid., ii, p. 182] were observed—one in the sporangial phase of culture, hyaline to straw-coloured, germinating like conidia, while the other was abundant among the sexual organs, resembling oogonia in size and colour, and often forming multiple internal spores. The subspherical to piriform, mostly terminal oogonia are formed in profusion on oatmeal and maize meal agar and measure 40·6 by 34·9 μ. Only one mature oospore was observed. The antheridia are paragynous, clavate, or short and irregularly rounded. From these characters the fungus would appear to be referable to *P. cactorum* [*R.A.M.*, x, p. 754], though the oogonial dimensions are larger than those given for the latter species. Considerable details of the cytology of the fungus are given.

Inoculation experiments with the watermelon fungus gave positive results on green and ripe watermelons and tomatoes, ripe apple, pear, and orange fruits, green Bell pepper [*Capsicum annuum*] and cucumber fruits, leaves of *Agave americana* var. *marginata*, and stems of tomato and *Cereus schottii*.

Some diseases and pests of cultivated Mushrooms.—Pamphlet issued by W. Darlington & Sons, Ltd., Worthing, Sussex, 23 pp., 10 figs., 1932. [Received January, 1934.]

In this pamphlet, dealing mainly with the insect pests of cultivated mushrooms (*Agaricus* [*Psalliota*] *campestris*), short notes are given on the cause and control of plaster mould (*Oospora fimicola*), mushroom-bed sclerotium (*Xylaria vaporaria*), and 'bubbles' or 'weeping disease' (*Mycogone perniciosa*), all of which, together with *Cephalosporium costantinii*, *C. lamellaecola*, *Verticillium* sp., and *Pseudomonas tolaasii*, have been reported from Great Britain [*R.A.M.*, xii, p. 72].

Jöhnssen (A.). **Über die Reisigkrankheit der Rebe.** [On the twig disease of the Vine.]—Reprinted from *Der Deutsche Weinbau, 1933*, 17–20, 10 pp., 10 figs., 1933.

The writer's observations and experiments [which are fully described] on the 'reisigkrankheit' of vines [*R.A.M.*, ix, p. 83] in the Ahr district of Germany, the most prominent symptoms of which are the dwarfing and zigzag formation of the shoots, with short, thin internodes, swollen lower nodes, small, crowded leaves,

small berries, and irregular tendril formation, are regarded as fully confirming the virus origin of the disorder [cf. ibid., xii, p. 419; xiii, p. 170]. Neither vegetable nor insect pests have been found associated with diseased vines, while the essential features of the 'reisigkrankheit' are analogous with those of certain recognized virus disturbances. The disease is considered to be due to the same cause as roncet, court noué, and leaf curl (arricciamento) in other countries. It was experimentally shown by the writer in the greenhouse and in the field that the condition is transmissible in the Spätburgunder variety through the soil, by contact of the roots, and by grafting. Spread from plant to plant takes place, but the exact means by which this occurs is not known. In American vines the early symptoms are less marked than in the European varieties. 'Reisigkrankheit' is characterized microscopically by the development in the vessels of 'cordons endocellulaires' [ibid., vii, p. 556; xi, p. 21], these being the most reliable diagnostic character.

BRANAS (J.) & DULAC (J.). **Sur le mode d'action des bouillies cupriques au moment de leur emploi.** [On the mode of action of copper mixtures at the moment of their use.]—*Comptes rendus Acad. des Sciences*, cxcvii, 17, pp. 938–941, 1933.

Starting from the hypothesis that the toxicity of a copper mixture to *Plasmopara viticola* depends on its content of dissolved copper irrespective of the nature of the copper compounds [*R.A.M.*, xii, p. 674], the writers ascertained by laboratory tests [details of which are given] that there is a sufficiency of dissolved copper in 2 per cent. Burgundy and Bordeaux mixtures whether of acid, neutral, or alkaline reaction (at least $\frac{1}{20.000}$) to afford absolute protection at the moment of use. The solubility of the compounds after desiccation and that of the deposits on the leaves is another question.

Reports on the work of Agricultural Research Institutes and on certain other agricultural investigations in the United Kingdom. 1931–1932.—395 pp., London, H.M. Stationery Office, 1933.

In this compilation (prepared on the same lines as that of the preceding year) [*R.A.M.*, xii, p. 139] a greatly condensed account is included of the phytopathological work carried out at the various research stations, the laboratories of the Ministries of Agriculture for England and Northern Ireland, and the Department of Agriculture for Scotland, as well as of the local investigations at advisory centres throughout the United Kingdom. Most of the information in question has already been noticed in this *Review* from other sources.

SIMMONDS (J. H.). **The work of the Pathological Branch.**—*Ann. Rept. Queensland Dept. of Agric. & Stock for the year 1932–3*, pp. 61–63, 1933.

During the period under review disease was a major factor in influencing the development of the tobacco industry in Queensland. In the southern parts of the State blue mould [*Peronospora taba-*

cina: *R.A.M.*, xiii, p. 132] was by far the most serious disease of this crop, planting frequently being greatly delayed owing to the loss of seedlings. In northern localities frog-eye (*Cercospora nicotianae*) [ibid., xii, p. 794] was of greater importance, and owing to exceptionally wet weather reached epidemic proportions, the damage caused being particularly noticeable during curing.

Evidence was obtained that banana speckle [ibid., xii, p. 457], hitherto regarded as of minor importance, is capable of causing even greater loss of leaf than leaf spot (*C. musae*) [ibid., xii, p. 456].

It was ascertained that both brown and black spot [*Colletotrichum gloeosporioides* and *Phoma citricarpa*, respectively: ibid., x, p. 161; xii, p. 335] of Emperor mandarins [*Citrus nobilis* var. *deliciosa*] may be controlled by spraying with Bordeaux mixture (3–2–40).

An extensive series of field plots was laid down to obtain further information on the effect of soil conditions on pineapple wilt [ibid., xii, p. 520].

From a serious disease of papaw referred to as 'black fruit spot and stem canker' and attributed partly to an exceptionally cold winter a fungus [unnamed] was isolated, the pathogenicity of which was established. In parts of Southern Queensland the winter is sufficiently cold to kill the lower leaves of susceptible varieties and produce scalding of the exposed surface of the fruit. The fungus was able to set up infection through the injured tissue, producing a large, black, sunken spot on the fruit and causing the leaf stalk to decay. It sometimes spread back into the main stem and caused a serious canker.

Black root of beetroot (*Nematosporangium* [*Pythium*] *aphanidermatum*) [ibid., x, p. 768] and downy mildew of lettuce (*Bremia lactucae*) were recorded for the first time in Queensland.

Young hoop pines [*Araucaria cunninghamii*] were killed by a seedling blight and stem rot frequently associated with a *Fusicoccum* and a *Diplodia*.

PATEL (M. K.). **India: diseases in the Bombay Presidency.**—*Internat. Bull. of Plant Protect.*, vii, 11, p. 246, 1933.

Septoria cannabis [*R.A.M.*, viii, p. 199] is recorded for the first time in the Bombay Presidency on hemp (*Cannabis sativa*). *Uromyces fabae* [ibid., xii, p. 596] and *Erysiphe polygoni* [ibid., xi, p. 224] are stated to be causing heavy damage to sweet peas in the Poona district, this being their first reported occurrence in India on the host in question.

THOMPSON (A.). **Division of Mycology. Annual Report for 1932.**—*Dept. of Agric. Straits Settlements and Fed. Malay States* (*Reports of the Res., Econ., and Agric. Educ. Branches for the year 1932*) *Bull. 14, Gen. Ser.*, pp. 53–62, 1933.

In 1932, at the Experimental Station, Serdang, stem rot of oil palms (*Fomes noxius*) [*R.A.M.*, xii, p. 354] produced the highest percentage of infection in a block of poorly developed palms on a clay soil overlying a hard pan. It has not yet been possible to determine how long elapses under average estate conditions between the onset of stem infection and the death of the palm. *F. noxius*

was found on a leaf base with a mottled brown and white decay that had not reached the stem tissue, its fruit bodies being evidently produced sometimes at the beginning as well as at the end of an attack on the palm. Two infections were examined in which the bases of the palms were covered with the fructifications of *F. lignosus*; the mycelium was growing on the roots, but had not penetrated the tissues.

Tea diseases recorded from the Cameron Highlands included red root disease (*Poria hypolateritia*), red rust (*Cephaleuros parasiticus*), brown blight (*Colletotrichum camelliae*) [*Glomerella cingulata*], and leaf spot (*Cercosporella theae*) [ibid., vii, p. 746]. In the same locality die-back of Arabica coffee occurred unaccompanied by leaf disease (*Hemileia vastatrix*), in some cases extending to the larger branches; a *Colletotrichum* was found in profusion on the dying twigs. The most serious disease of tobacco was *Bacterium solanacearum* [ibid., xi, p. 769; xii, p. 355], which on some smallholdings where tobacco had previously been grown caused losses ranging from 10 to 80 per cent. of the crop. The presence of brown rot of potatoes caused by *Bact. solanacearum* in the Cameron Highlands was confirmed. On newly opened, uncleared land *F. lignosus* caused serious damage to pepper [*Piper nigrum*]. A *Collybia* was isolated from *Shorea leprosula* seedlings attacked at soil level by a white mycelium resembling thread blight which encircled the stem and spread upwards by means of thin rhizomorphs; the hyphae penetrated into the base of the stem, causing a dry rot of the wood and killing the plants. The fructifications of the fungus, which developed on material kept in a damp chamber, were small, the cap being about 0·5 cm. in diameter, orange-brown, later white and transparent, while the white, slender stalk averaged 0·5 in. long. Powdery mildew of pumpkin leaves was recorded, perithecia of *Erysiphe cichoracearum* [ibid., vi, p. 716] accompanying the conidial stage.

Other records included a *Diplodia* causing collar rot and death of avocado seedlings following the sudden removal of overhead shade, *Sphaerostilbe repens* attacking the roots of the same host, with fatal results, and *Phytophthora parasitica* causing wilting of roselle fibre plants [*Hibiscus sabdariffa*].

In further investigations into the bacteria and moulds causing deterioration of copra [cf. ibid., xii, p. 355] inoculation tests showed that the greatest amount of injury was produced when bacteria and *Aspergillus flavus* [ibid., ix, p. 177; xi, p. 175] were used together.

LEACH (R.). **Report of the Mycologist for 1932.**—*Ann. Rept. Dept. of Agric., Nyasaland, 1932*, pp. 53–54, 1933.

The following information, apart from that already noticed from other sources, is contained in this report. A species of *Rhizoctonia* closely allied to *R.* [*Corticium*] *solani* was isolated from tea seedlings raised from valuable imported seed, on which black lesions were formed at the stem bases, partially or entirely girdling them and generally killing the young shoots. *Armillaria mellea* was found on one estate to be killing the green manure plant, *Tephrosia candida*, from which it had evidently spread to the tea.

Experiments on cowpea (*Vigna* sp.) showed that in plots receiving sodium sulphate in addition to nitrophoska the number of root nodules produced was about ten times as high as in those without sulphur. The leaves were also larger and more numerous in the sulphate-treated plots. These observations are of interest in relation to the etiology of tea yellows [*R.A.M.*, xii, p. 537].

McDonald (J.). **Annual Report of the Senior Mycologist for 1932.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1932*, pp. 124–134, 1933.

Field observations during 1932 lent weight to the theory that severe attacks of the coffee berry disease [*Glomerella cingulata*: *R.A.M.*, xii, p. 8] in certain areas may be associated with excessive or unbalanced supplies of nitrogen. For two seasons the Blue Mountain variety has remained practically free from infection.

The physiologic form K4 of wheat black rust (*Puccinia graminis tritici*) [ibid., xii, p. 13] appears to be distinct from all those known in other parts of the world. A sample of black rust from Iringa, Tanganyika Territory, was found to be identical with form K3, already known in Kenya. In a collection of rusted barberry (*Berberis holstii*) leaves made in April, a teleutospore stage was found developing in some of the uredo pustules; the rust forms now recorded on this host in Kenya are two types of aecidia, with one of which pycnidia are associated, uredo- and teleutospore pustules. Negative results were given by inoculation tests on wheat by the aecidiospores from barberry.

C. A. Thorold reports that take-all of wheat (*Ophiobolus graminis*) [ibid., xii, p. 9] is a limiting factor in production at the higher altitudes (from 7,500 ft. upwards). Since the fungus cannot long persist in the soil in the absence of cereals or grasses, the adoption of a suitable rotation or clean fallow system should afford control [ibid., xiii, p. 87].

A species of *Fusarium* was shown by inoculations to be responsible for a destructive wilt of groundnuts on the coast, the infected plants collapsing suddenly after 16 to 30 days while the uninoculated controls remained healthy. The fungus was reisolated from four of the five inoculated plants.

Investigations were also carried out on bacterial blight of beans [*Phaseolus vulgaris*], probably due to *Bacterium medicaginis* var. *phaseolicola* [ibid., xii, p. 9], and on linseed rust (*Melampsora lini*), a new disease for the Colony.

A year's progress in solving farm problems of Illinois 1932–33. Forty-sixth Annual Report for year ended June 30, 1933.—295 pp., 24 figs., 11 diags., 7 graphs, 1933.

The following are among the items of phytopathological interest (some of which have already been noticed from other sources) scattered through this report. The average annual maize crop during the past ten years is estimated at 321,788,400 bushels, of which one-fourth is destroyed by disease before harvesting, representing a loss of almost 80½ million bushels or nearly 18 million dollars even at the low price of 22 cents per bushel prevailing in 1932. Careful selection of seed reduced the losses from ear rots

(*Diplodia zeae*, *Fusarium* [*Gibberella moniliformis* and *G. saubinetii*], and *Basisporium* [*gallarum*: *Nigrospora* spp.]), and improved the yield by an average of 12 per cent. in five years' experiments with the Reid Yellow Dent variety by B. Koehler [*R.A.M.*, viii, p. 292; xii, p. 12]. Preliminary observations indicated that maize infested by *D. zeae* was less palatable to pigs than sound grain.

Studies by E. W. Lehmann, R. H. Reed, H. W. Anderson and R. L. McMunn showed the cost of operation of a stationary spraying plant to be 25 to 65 per cent. below that of a portable plant, dependent on the number of laterals and outlets installed. The time required to move from one tree to the next was increased by 7¼ to 13½ per cent. by extending the group of trees perpendicular to the pipe line, e.g., by 7 to 9 or 5 to 7. In the spring of 1933 the owners of stationary plants were able to apply the regular spraying programme, while those employing portable systems were prevented by the frequent heavy showers.

Apple measles [ibid., xii, p. 749] has been observed by H. W. Anderson to be most prevalent in orchards on tight clay types of soil of the grey silt-loam region; there is some indication that the disease may be combated by the excision of affected branches, liming of the soil, and planting legumes to provide nitrogen and humus. For the present it is inadvisable to plant Delicious and its red sports in the grey silt-loam region owing to their susceptibility to measles.

A Pythiaceous fungus causes a destructive root rot of strawberries, which has been found by H. W. Anderson and A. S. Colby in Vermilion County to be prevalent on heavy clay soils. Abundant oospores were found in the root tissues, but attempts to culture the fungus proved unsuccessful, nor did healthy plants contract the disease when grown in contaminated soil in the greenhouse. It appears, therefore, that the fungus only assumes a virulent form in soils with a high water-holding capacity.

A new tomato variety, Century, developed by W. A. Huelsen and W. H. Michaels, is stated to compare very favourably with Marglobe as regards resistance to *Fusarium* [*lycopersici*: ibid., xii, p. 12; xiii, p. 194]. In total-average production of U.S. Cannery Nos. 1 and 2 grades in 1932 Century outyielded Marglobe by 9·78 per cent.

Tu (C.). **Notes on diseases of economic plants in South China.**—*Lingnan Sci. Journ.*, Canton, China, xi, 4, pp. 489–504, 10 pl., 1933.

Since 1930 the writer has been engaged on a survey of the diseases affecting economic crops in South China, some preliminary notes on the more important of which are here given. Amongst the diseases recorded the following may be mentioned. Cabbage in the Canton district suffers heavy damage from a *Sclerotinia* [? *sclerotiorum*: *R.A.M.*, x, p. 118], recognizable by the flocculent, white aerial mycelium and large black sclerotia on the surface or embedded in the host tissues. The yield may be reduced by 20 per cent. or more. Yellows (*Fusarium conglutinans*) also occurs in a mild form on the same host.

The recently introduced varieties of papaw have been found

extremely susceptible to anthracnose (*Gloeosporium papayae*) [ibid., xi, p. 223].

A chilli variety is affected by leaf curl [ibid., xi, p. 781], characterized by downward curling, pallor, stunting, and extreme brittleness of the upper foliage.

The severity of black spot of oranges (*Phoma citricarpa*) [see above, p. 215] is stated to be steadily increasing, especially on mandarins. Scab (*Sphaceloma fawcettii*) has been found coextensive with Chinese lemon (*Citrus limonia*) cultivation [ibid., xii, p. 626], the young leaves, twigs, and fruits being commonly attacked. All the citrange [*C. sinensis* × *Poncirus trifoliata*] varieties are also highly susceptible in the juvenile stage, whereas sweet and mandarin oranges show a high degree of resistance to this disease.

Most Japanese mulberry varieties at the Department of Sericulture are affected by mosaic [cf. ibid., x, p. 398], characterized by typical mottling and in severe cases by extensive crinkling and stunting.

Septoria pyricola [ibid., xi, p. 267 ; xiii, p. 76] occurs in a severe form on native sand pears [*Pyrus serotina*: ibid., v, p. 107], which are also liable to a mild type of fireblight (*Bacillus amylovorus*) [cf. ibid., x, p. 644].

The Khapli, Marquillo, and native wheat varieties are severely attacked by *Sclerotium rolfsii* [ibid., viii, p. 34].

Heavy damage is inflicted on Chinese olives (*Canarium album*) by a gall closely resembling the crown gall due to *Bacterium tumefaciens*.

Heubel (G. A.). **Het voorkomen en ontstaan von stikstofknobbeltjes in de bladeren van verschillende Rubiaceeën en de eventueele beteekenis daarvan voor de cultures.** [The occurrence and origin of nitrogen nodules in the leaves of various Rubiaceae and their potential importance for cultivation.]—*De Bergcultures*, vii, 45, pp. 1246–1249, 3 figs., 1933.

In the annual report for 1932 of the Malakka Experiment Station the cultivation of shrubby Rubiaceae as green manures in rubber plantations is recommended, presumably on account of the nitrogen-fixing bacteria contained in the leaves of many species, e.g., of *Pavetta* (including *P. indica*) and *Psychotria* (*P. bacteriophila*) [*R.A.M.*, vii, p. 799]. Von Faber's investigations (*Jahrb. Wiss. Bot.*, 1912 and 1914) showed that the leaf buds of such plants exude a foamy mass containing rod-shaped bacteria (*Mycobacterium rubiacearum*) which penetrate the young, furled leaves through stomata or other apertures and dissolve the cell-walls to form cavities. In this respect the organism behaves as a true parasite to which the plant reacts by the secretion of an antitoxin and the formation of a semi-impenetrable barrier whereby the bacterial colonies are isolated. New cells rapidly grow out into the cavity and the multiplication of the organism in the newly formed tissue which constitutes the visible nodule no longer adversely affects the host, the association, on the contrary, benefiting both partners.

Bacterium-free plants, raised from seed sterilized by immersion for 25 minutes in water at 50° C., showed a considerable reduction of germinative capacity and vigour compared with those grown

from 'infected' seed. *M. rubiacearum* originates in the seed and is conveyed from the growing point into the leaves and flower buds, whence it passes into the embryo sac of the ovules and so back into the seed. Fresh inoculation from the soil, as required in the case of the Leguminosae, is therefore superfluous with the Rubiaceous symbionts. So closely interdependent are the latter and their hosts that the bacteria are unable to survive the death of the plants.

Von Faber's experiments showed that *M. rubiacearum*, growing on a non-nitrogenous medium, is able to fix considerable quantities of nitrogen from the atmosphere. It was also found that bacterium-free plants were unable to grow in sand and water cultures without nitrogen, whereas those containing bacteria made satisfactory progress. Probably the use of Rubiaceous plants on Java rubber estates would be equally advantageous with that of the commonly cultivated Leguminosae.

FAULKNER (O. T.). **Black pod disease of Cacao.**—*Rept. Agric. Dept. Nigeria for the year 1932*, pp. 32–34, 1933.

A series of four experiments is in progress near Ibadan to determine the efficacy of various control measures against black pod disease [*Phytophthora palmivora*: *R.A.M.*, ix, p. 166] on native cacao farms in Nigeria. One part of each plot has been left untouched as a control, while the other was thinned and pruned at the beginning of the trials in 1931. The thinned and pruned part of each plot further received one or other of the following additional treatments: three applications during the year of Bordeaux mixture, dusting with a copper dust, dusting with finely divided sulphur, or 'thorough sanitation', comprising the burying of all husks and diseased pods, and branches. In 1932–3 the percentages of infection in the plots receiving each of these treatments were 2, 2·6, 3·1, and 5·5, respectively, the corresponding figures for the controls being 10·8, 5·4, 10·3, and 4·7. The district under observation is stated to be thoroughly infested by black pod, so that these figures give a fairly correct idea of the extent of the disease. But for the frequent harvesting of the crop, which is one of the most effective measures against black pod, the losses from the disease would have ranged from 4 to 12·5 per cent. in different years and fields. In 1932–3 the yield from the Bordeaux treated half of the plot was 856 lb. of dry cacao per acre as compared with 523 lb. for the control portion, the corresponding figures for the copper and sulphur dusts and thorough sanitation treatments being 745 (907), 1,216 (1,160), and 750 (630), respectively.

KADEN (O. F.). **Untersuchungsergebnisse über nichtparasitäre Kakaokrankheiten in San Tomé und Principe.** [Results of investigations on non-parasitic Cacao diseases in St. Thomas and Prince's Islands.]—*Der Tropenpflanzer*, xxxvi, 8, pp. 321–340, 1933.

The first extensive outbreaks of the so-called 'morte subita' or 'plethora' disease of cacao in St. Thomas Island, Gulf of Guinea, are stated to date from the period between 1921 and 1925 when

the plantations were devastated by thrips (*Heliothrips rubrocinctus*). A temporary cessation was followed by a renewal of the epidemic in 1927. Some idea of the extent of the losses may be given by the numbers of deaths, estimated at 55,000 trees in a single plantation in 1925 and at over 70,000 in another during the last three years. The leaves of apparently vigorous trees suddenly assume a limp, glassy appearance, turn yellow within a few hours, and generally die in two or three days. A temporary recovery may occasionally be effected by drastic pruning to stimulate new growth, supplemented by the application to the soil of 5 per cent. iron sulphate. The withered leaves emit an odour of ripe apples on crumbling in the hand. No trace of parasitic agency has been detected, though the finer absorbing roots of affected trees are desiccated. The disease is most prevalent in the yellow Brazilian Amelonado (St. Thomas Criolla) plantings of eight years old and upwards, the red Central American varieties and their hybrids being relatively resistant. 'Morte subita' is confined to the compact soils (mostly red loam) of the interior and south of the island, reaching its climax at the beginning of the dry season (June to August).

Discussing the etiology of 'morte subita' the writer draws attention to the gradual modification of the insular climate, largely under the influence of the excessive deforestation and drainage of swamps to meet planting requirements. Formerly enjoying a temperate moist warmth throughout the year, the island is now subject to sharply fluctuating extremes of temperature and humidity to which cacao is naturally sensitive. The importance of this factor in the causation of 'morte subita' is suggested by its complete absence from Prince's Island until 1929, when large forest areas were cleared and the climatic conditions underwent the changes described above; at this time the first cases of the disease were recorded. Another underlying cause of the apparently 'sudden' death of the trees is aluminium poisoning resulting from the poverty of the soils in exchangeable lime. Suggestions are made for combating the disease by systematic reafforestation, thorough soil sanitation, fertilizing with lime, organic manure, and compost, green manuring (e.g., with *Crotalaria retusa*), adequate shade provision, deep planting, and the use of resistant Venezuelan varieties.

'Mela' (yellow fruit) is stated to have increased steadily during the past decade, ruining the harvest prospects of the last two years. The fruits may reach a length of 12 cm. before shrivelling from the tip downwards. Like the foregoing disease, 'mela' appears to be primarily a sequel to abrupt climatic changes, and in the writer's opinion the associated fungi (e.g., *Lasiodiplodia* [*Botryodiplodia*] *theobromae* and *Colletotrichum luxificum*) [*R.A.M.*, v, p. 149] are purely secondary. This trouble, which occurs even in the superior soils in the north of St. Thomas, may be largely prevented by the establishment of windbreaks and the application to the soil of wood ash and potash salts. Similar causes and remedies are operative in the cases of precocity and hardening of the fruit, which are prevalent in both islands during the June to October monsoon and give rise to defective beans after fermentation. In

new plantations the Angoleta and Cundeamor varieties should replace the locally grown Amelonado.

Nanism is another condition of recent development in which the affected trees fail to attain more than 1 m. in height; the shoots remain slender and early turn brown, leaves, fruits, and seeds are abnormally small, and flowers scanty. In the deforested regions of Prince's Island the occurrence of dwarf trees is general. As early as 1907 C. Gravier drew attention to the gradual dying-off of old cacao trees in the north of St. Thomas (*Bull. Mus. Hist. Nat.*, p. 213), which presents analogies with the die-back described by Fernandes and van Dijk from Surinam [*R.A.M.*, vi, p. 603]. Secondary parasites on affected trees include *B. theobromae*, *C. luxificum*, and *Cephaleuros virescens* [*C. mycoidea*: ibid., ix, p. 632]. The sole cure for these disorders is the restoration to the trees of the essential conditions of growth—good soil, humidity, shade, and protection from wind.

Burton (G. J. L.) & Lathbury (R. J.). **Annual Report of the Senior Plant Breeder for 1932.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1932*, pp. 141–148, 1933.

Apart from take-all [*Ophiobolus graminis*: see above, p. 217], wheat diseases were not specially prevalent in Kenya during the period under review.

Cross No. 112, the parents of which are a Njoro wheat and an English hybrid, proved resistant to form K4 of black rust [*Puccinia graminis tritici*: loc. cit.], though succumbing to a severe epidemic of form K2 at Mau Summit. This cross was also resistant to yellow rust [*P. glumarum*] at 8,500 ft. So far Cross No. 130 (Njoro × a selection of Australian Florence) has been exposed only to forms K1 and K4 of black rust, with promising results. Both the parents are resistant to *P. glumarum*. Cross No. 131 (Njoro × Florence) has proved highly resistant to form K1 and (in the F_3 generation) to K2 of *P. graminis tritici*, as well as to yellow rust [cf. *R.A.M.*, xii, p. 13]. These encouraging results give ground for hope that the present danger from rust may shortly be eliminated to a great extent in the Colony.

Maize breeding with a view to the development of resistance to white blight (*Helminthosporium turcicum*), *Fusarium* rots [loc. cit.], and rust [*P. maydis*] is in progress under the supervision of C. Maher in the Trans Nzoia. A considerable advance has already been made in respect of the first-named disease, but the *Fusarium* rots still present a complex problem.

Remsberg (Ruth) & Hungerford (C. W.). **Certain Sclerotium diseases of grains and grasses.**—*Phytopath.*, xxiii, 11, pp. 863–874, 4 figs., 1933.

'Snow scald' is the name proposed by the writers for the disease first observed in the Idaho wheat fields in 1922 [*R.A.M.*, iii, p. 267] as being appropriate to the scalded appearance of the plants. It has recurred annually in the same region since, and in the spring of 1931 the damage it caused in the experimental wheat and barley

plots at the Sandpoint Substation ranged from 5 to 85 per cent., the yield in some cases being reduced by 75 per cent. In each of the years 1922, 1926, 1929, and 1932 the injury from snow scald necessitated the re-sowing of winter wheat over hundreds or even thousands of acres.

Isolations from ten collections of snow-scalded wheat, barley, and grasses yielded 14 sclerotial fungi, which can be placed in four groups according to their morphological and physiological characters [ibid., xii, p. 367]. The sclerotia of group I (wheat and unspecified material) germinate rapidly and profusely and range from 0·1 to 2 mm. in diameter; they are light brown to black at maturity, devoid of a rind, spherical to oval, and smooth. Those comprising group II (wheat, barley in Idaho and Japan, and an unspecified grass in New York) are dark brown, spherical to irregular, rough or smooth, devoid of a rind, 0·9 to 4 mm. in diameter, and present an agglomerated appearance owing to their relatively slow formation. The sclerotia of group III were obtained from wheat, timothy [*Phleum pratense*], and foxtail grass (*Alopecurus fulvus*) in Japan, and from an unspecified grass, *Dactylis glomerata*, and barley in Idaho; they frequently coalesce into large, spongy masses and are reddish-brown with a tough rind at maturity, rounded to irregular, superficially rough, and measure 1·1 by 1·5 to 2 by 4 mm. in diameter. In group IV, represented by only one culture from wheat in Idaho, the sclerotia are black, with a heavy black rind surrounding a white medullary area, and measure 4 by 5 to 6 by 10 mm. in diameter. The optimum temperatures for sclerotial growth in groups I, II, III, and IV were found to be 10°, 5°, 0° to 5°, and 5° C., respectively; from 10° to 20° there was a marked decline and above 25° development was entirely arrested. Definite classification of the organisms is impossible pending the establishment of the complete life-cycle, but those belonging to group III are tentatively referred to *Typhula graminum*.

Schmidt (E.) & Tornow (E[lisabeth]). **Vereinfachte Methode zum Nachweis des Quecksilbers und der Beizung von Getreide mit Quecksilber- und Kupfersalzen.** [A simplified method for the detection of mercury and of the treatment of seed-grain with mercury and copper salts.]—*Prakt. Blätter für Pflanzenbau u. Pflanzenschutz*, xi, 8, pp. 177–183, 1933.

The writers' electrolytic method for the determination of mercury in disinfectant preparations and in treated seed-grain [*R.A.M.*, xii, p. 305] has been simplified by the immersion for ¼ to 2 minutes of a thin strip of aluminium in a boiling solution of 25 per cent. thiosulphate containing 5 per cent. potash lye. In the presence of mercury the oxidation of the aluminium will be completed within the period mentioned. Copper may be similarly detected by a black deposit of copper sulphide on the sides of the test-tube and on the aluminium, as well as by the black or grey colour of the scum.

Krebs (J.). **Der Einfluss der Bodentemperatur auf die Infektion von Weizenkeimlingen durch Ophiobolus graminis Sacc., dem Erreger der Schwarzbeinigkeit.** [The influence of soil

temperature on infection of Wheat seedlings by *Ophiobolus graminis* Sacc., the agent of blackleg.]—*Schweiz. Landw. Monatshefte, 1933*, 11, pp. 285–291, 8 figs., 1 graph, 1933.

Using two physiologically distinct strains (A and B) of *Ophiobolus graminis*, the writer carried out a series of inoculation experiments under controlled conditions at Zürich on Heine's Kolben summer wheat at 14 soil temperatures ranging from 3° to 42° C. The two strains reacted differently to the influence of soil temperature, infection by A being readily obtained at a range from 9° to 24° with an optimum between 12° and 15°, the corresponding figures for B being 18° to 27° (24°). Control should be based on late sowing of winter wheat and early sowing of the summer crop. *O. graminis* has not yet assumed such serious proportions in Switzerland as in Germany [*R.A.M.*, xiii, p. 154], but may fairly often be observed in conjunction with the other agents of foot rot, *O. herpotrichus*, *Leptosphaeria herpotrichoides*, and *Calonectria graminicola*.

Kingsley (Eunice L.). **The relation of certain morphological characters of the host and fungus to the identification of the loose and covered smuts of Oats.**—*Trans. Kansas Acad. Sci.*, xxvi, pp. 98–104, 1933.

After pointing out that loose smut (*Ustilago avenae*) and covered smut (*U. levis*) [*U. kolleri*] of oats are not readily distinguishable by the characteristics of the smutted panicles alone and that the two cannot be separated without examination of the spores for the presence or absence of echinulations, the author states that herbarium material is apparently often wrongly determined. A very thin, whitish membrane over the spore masses is almost always present in *U. kolleri* and absent in *U. avenae*, and is regarded as a very important diagnostic character. The amount of visible smut present or the proportion of the glumes affected is not a reliable indication of the species concerned. The smut on some panicles probably results from infection by a hybrid of both species [cf. *R.A.M.*, xii, p. 622], as shown by the intermediate characters of the symptoms on the smutted panicles and of the spores.

In the southern part of the Great Plains *U. avenae* (to which Kanota and Fulghum oats in this locality are highly susceptible) appears to be the more prevalent species, collections from Kansas, Oklahoma, and Texas largely consisting of it.

Sanford (G. B.). **A preliminary note on an unreported rootrot of Oats.**—*Scient. Agric.*, xiv, 1, pp. 50–51, 1 pl., 1933. [French summary on p. 53.]

A brief description is given of a serious root rot of oats which developed over a wide area in the Edmonton district of Alberta in 1933, and the symptoms of which were most marked on plants from four to eight weeks old. The lower leaves of the affected plants drooped, turned light brown to reddish, and slowly withered, while the plants assumed an upright habit, and were more or less stunted and chlorotic according to the severity of attack. The

plants tended to recover as the crown roots developed, but the size and number of spikelets produced was definitely reduced, and the diseased plants had commonly but one tiller. The primary roots were greatly reduced from their normal development, and together with the sub-crown internode usually became straw-coloured. While sclerotium-like bodies composed of fungal hyphae were observed on the underground organs and occasionally above the crown, the cause of the disease has not yet been established.

B. (R. E. D.). **Maize stripe disease.**—*Trop. Agriculture,* x, 8, p. 221, 1933.

In March, 1933, sorghum growing in Trinidad developed leaf symptoms resembling those of maize stripe [*R.A.M.*, xii, p. 756] which was experimentally transmitted by the leafhopper *Peregrinus maydis* from maize to sorghum with the production of symptoms resembling those on sorghum in the field. It is concluded that the two diseases are identical.

Barjaktarovič (S. S.) & Bogdanovič (S. B.). **Untersuchungen über die Wirkung des Maisbrandes (Ustilago maidis).** [Investigations on the action of Maize smut (*Ustilago maydis*).]—*Arch. Exper. Path. u. Pharmakol.,* clxxiii, 4–6, pp. 381–387, 1933.

In connexion with a study on the pharmacological uses of maize smut (*Ustilago maydis*) [*U. zeae*] in Bulgaria, the writers conducted inoculation tests [details of which are given] on young rabbits of both sexes with a macerated infusion of spore dust. The fresh preparation was found to induce slight hyperglycaemia, but after keeping for a year this property was lost. Both in the fresh state and after keeping for a year the infusion arrested or reversed adrenalin hyperglycaemia, whether administered before or after the adrenalin, and the continuous administration of the smut preparation reduced or prevented the condition in question. It is concluded, therefore, that *U. zeae* contains a substance which acts similarly to ergotamin on adrenalin hyperglycaemia [*R.A.M.*, xi, p. 38].

Voorhees (R. K.). **Effect of certain environmental factors on the germination of the sporangia of Physoderma zeae-maydis.**—*Journ. Agric. Res.*, xlvii, 8, pp. 609–615, 1933.

In the controlled experiments briefly reported in this paper the sporangia of *Physoderma zeae-maydis* [*R.A.M.*, xii, p. 431] were shown to germinate equally well in tap water, distilled water, and maize leaf extract. Continuous renewal of fresh air in the culture containers did not appear to be an essential factor for germination. Direct sunlight appeared to have a lethal effect on the sporangia, which germinated best in a moist chamber receiving light from a north window; total darkness inhibited the germination. The optimum reaction of distilled water for germination was P_H 7·4, at which 88 per cent. of the sporangia liberated zoospores, while at P_H 2·5 there was no germination. Total absence of oxygen inhibited the germination, but the sporangia germinated as freely in 20 per cent. oxygen as in normal air; this percentage of oxygen

changed the P_H value of the distilled water used from 6·9 to 7·6. In the presence of 10 per cent. carbon dioxide the germination was reduced by only 1 per cent. of that (80 per cent.) in normal air. The sporangia were shown to be tolerant of a very wide range of temperatures, since zoospores were obtained from sporangia exposed for 30 days to temperatures as low as 0° and as high as 70° C., but they were killed after two days' exposure to 80°. When stored in laboratory bottles for one, two, and three years, the germination of the sporangia was 70, 46, and 0 per cent., respectively [cf. ibid., xii, p. 432].

Stakman (E. C.), Tyler (L. J.), & Hafstad (G. E.). **The constancy of cultural characters and pathogenicity in variant lines of Ustilago zeae.**—*Bull. Torrey Bot. Club*, lx, 8, pp. 565–572, 2 pl., 1933.

From a single monosporidial, unisexual line of maize smut (*Ustilago zeae*), W(est) V(irgini)a A8, 162 distinct lines arose as sectors in colonies of the original line and its variant derivatives [*R.A.M.*, ix, p. 713]. For the past 4½ to 5 years 14 variant lines, each apparently constituting a distinct biotype, have maintained their characteristic features on artificial media. After three years several of the mutants in their turn produced sectors, from which new lines were isolated, supporting the view that sectoring results primarily from mutation rather than from segregation, a relatively infrequent phenomenon which could scarcely have been so long delayed. Further weight is lent to this view by inoculation experiments on Northwestern Dent maize in 1932 with crosses between W.Va. A8 and several of its derivatives on the one hand and Minnesota A and Italy A1 on the other. The same results were obtained as in the 1928 tests with the same material on Golden Bantam, showing that their pathogenic characters had remained remarkably constant. Certain of the variants differed mutually and from the original line in pathogenicity factors, and the constancy of these differences indicated that genotypic changes were involved. Evidently, therefore, the so-called physiologic forms of the smuts may comprise a very large number of biotypes arising from monosporidial lines apparently by mutation.

Allen (Ruth F.). **The spermatia of Corn rust, Puccinia sorghi.** —*Phytopath.*, xxiii, 11, pp. 923–925, 1 fig., 1933.

A cytological study of *Puccinia sorghi* [*P. maydis*] from artificially inoculated *Oxalis* plants [*R.A.M.*, xii, p. 388] showed that the entry of the nucleus of the spermatium into the paraphysis is preceded by the secretion of a small mass of dark-staining matter at the point of attachment which serves to fix the spermatium to the hyphal wall. The nucleus passes from the spermatium into the paraphysis through an open channel [cf. ibid., xii, p. 777], the stages in its passage being clearly followed. Some indications were obtained that the spermatia fuse directly with young, vigorous paraphyses, whereas when the latter are old and decadent, the spermatia germinate and their germ-tubes grow down through the ostiole into the spermogonium.

Hayes (H. K.), Johnson (I. J.), & Stakman (E. C.). **Reaction of Maize seedlings to Gibberella saubinetii.**—*Phytopath.*, xxiii, 11, pp. 905–911, 1933.

Using a pure culture of the strain of *Gibberella saubinetii* from maize previously studied by McIndoe [*R.A.M.*, x, p. 724], the writers determined the reaction of seedlings (chiefly the F_4 and F_5 generations of hybrids developed at the Minnesota Agricultural Experiment Station, with a few selfed lines of Crosby and Golden Bantam) to replicated greenhouse inoculations with the organism at controlled soil temperatures ranging from 2° to 15° C.

It was found that the seedlings from the same ears showed sufficiently uniform results as to indicate that the method would be suitable for the isolation of lines that might be consistently resistant or susceptible. The results when tested over two seasons, however, indicated that inheritance is not the primary cause of the uniformity of reaction in different replicates from the same ear, which is evidently determined to some extent by the conditions under which the ear develops. It would seem, therefore, that a study of seedling blight by this method can scarcely advance the maize-breeding scheme, and other lines of investigation have accordingly been planned. No significant relationship was apparent between reaction to *G. saubinetii* and indices of plant vigour.

Melchers (L. E.). **Physiologic specialization of Sphacelotheca cruenta (Kühn) Potter.**—*Journ. Agric. Res.*, xlvii, 5, pp. 339–342, 1933.

The results of three years' pathogenicity tests at the Kansas Agricultural Experiment Station showed the existence of two physiologic strains of *Sphacelotheca cruenta* [*R.A.M.*, xii, p. 432], one of which (form 1) was originally obtained from India on Black Amber sorgo, and the other (form 2) was propagated from a single smutted head of a feterita plant which was found in the United States by Ficke in 1928, in a field containing many varieties of sorghum. Form 1 very readily attacks kafir × feterita and Pierce kaferita, which are not infected to any extent by form 2, while the latter heavily infects the varieties Red Amber × feterita and White Yolo which are immune from form 1. In general, the milos, feteritas, hegari, and Dwarf Shantung kaoliang were found to be extremely resistant to, if not immune from, both forms, but there was evidence that certain varieties of feterita and milo, generally regarded as immune, may be attacked by one or both forms. It is believed that other forms of *S. cruenta* may be found if additional collections of this smut are tested on a more extensive group of sorghums.

Melchers (L. E.). **Belated development of kernel smut (Sphacelotheca sorghi) in apparently healthy Sorghum plants.**—*Journ. Agric. Res.*, xlvii, 5, pp. 343–350, 1 fig., 1933.

The investigation reported in this paper was carried out from 1929 to 1932 at the Kansas Agricultural Experiment Station to determine whether the relatively low percentage of apparently infected plants usually obtained in infection experiments with the covered kernel smut of sorghum (*Sphacelotheca sorghi*) [*R.A.M.*, v,

p. 88; xii, p. 432] is due to an escape from infection, as suggested by Martin and Ratliffe [ibid., vi, p. 664] or whether the disease fails to develop despite the presence of the parasite in the host tissues. The results of the experiments on approximately 105 varieties, selections, and hybrids of sorghum, the seed of which was heavily inoculated with smut spores of five physiologic forms of *S. sorghi*, showed that cutting back the plants of susceptible varieties raised from such seed, which did not show the smut in the primary heads, was frequently followed by the development of the smut in the new growth of axillary shoots and in the shoots developed from sucker buds, thus showing that infection had succeeded and viable mycelium was present within the host tissues. Similar treatment of plants belonging to highly resistant or immune varieties, on the other hand, did not result in the production of smutted heads on the secondary growth, presumably because of the absence of viable hyphae in their tissues. A direct relationship was also noted between the degree of susceptibility (as expressed by primary head infection) of a given variety and the increase in covered kernel smut obtained by mutilation of the plants. Physiologic form 2, the milo form, not only attacked a greater number of varieties, including the usually resistant milo, hegari, and White Yolo, but also caused a higher percentage of covered kernel smut within a variety than the other four forms.

While the mechanism of infection and spread in the host tissues of *S. sorghi* has not yet been studied histologically, it is suggested that the infection hyphae of the parasite may invade not the apical cells of the plant but the meristematic regions farther back, where leaf and lateral stem differentiation is taking place, so that the apical portion might outgrow the infection and produce a smut-free inflorescence. This would be especially likely if invasion of the meristematic tissues occurs through division of cells containing mycelial fragments, and not through growth of the fungus from cell to cell.

BATES (G. R.). **Oil glands of Citrus fruits as an avenue of infection.**—*Nature*, cxxxii, 3341, pp. 751–752, 1933.

Freshly picked oranges inoculated by needle pricks with *Penicillium digitatum* between the oil glands showed little or no tendency to decay, whereas 80 to 100 per cent. of the fruits punctured by the needle in the oil glands developed rotting. In order to test the toxicity of the oil alone to the spores of the common orange-rotting fungi, *P. digitatum*, *P. italicum*, *Oospora-citri-aurantii*, and *Colletotrichum gloeosporioides*, a small quantity extracted from Valencia oranges was placed in test-tubes with a heavy spore inoculum and maintained at 39° and 67° F., small loopfuls of the suspension being transferred at intervals to prune agar. The thin-walled spores of *O. citri-aurantii* and *C. gloeosporioides* were killed immediately by the oil at both temperatures, whereas those of *P. digitatum* required eight hours' immersion in the oil at 67° to kill them and were still germinating slowly after 50 hours at 39°. The spores of *P. italicum* reacted to the oil in approximately the same way as those of *P. digitatum*. The fact (apparently not hitherto observed) that the oil glands serve as

channels of infection by *Penicillium* spp. further emphasizes the necessity for extreme care in the handling of the fruit.

MAYNE (W. W.). **Annual Report of the Coffee Scientific Officer, 1932–1933.**—*Mysore Coffee Exper. Stat. Bull.* 10, 16 pp., 1933.

During the period under review homogeneous cultures representative of the two strains of *Hemileia vastatrix* recently discovered [*R.A.M.*, xi, p. 636] were established on living coffee leaves at the Mysore Coffee Experiment Station. Cultures thus isolated and tested were utilized in estimating the resistance to leaf disease of coffee seedlings produced at the Station, the first results obtained indicating that resistance is dominant to susceptibility. It is considered to be very probable that the mode of inheritance follows comparatively simple Mendelian lines. Evidence was obtained that in resistant leaves entrance of the germ-tube takes place normally, and that the entering tube may proceed to the formation of haustoria. Preliminary experiments showed that shade reduced the vigour of spore production.

Pure cultures of *Fomes lamaoensis* [*F. noxius*: ibid., xi, p. 367; xii, p. 55] on wood blocks were buried in contact with the tap-root or lateral roots of four coffee plants in tubs, and about fourteen months later two of the inoculated plants showed typical symptoms of brown root disease; the wood blocks had been placed in direct contact with the tap-root of the plants which subsequently became infected, whereas in the two which remained healthy they had been placed near a lateral root.

Notes are given on further studies of the effect of spraying coffee at different times with mixtures of various strengths [chiefly against *H. vastatrix*, *Corticium koleroga*, and die-back: see next abstract].

The evidence obtained in 1932–3 strongly supported the view previously expressed that black bean disease of coffee [ibid., xii, p. 22] is associated with unfavourable climatic and nutritional conditions.

MAYNE (W. W.), NARASIMHAN (M. J.), & SREENIVASAN (K. H.). **Spraying of Coffee in South India.**—*Mysore Coffee Exper. Stat. Bull.* 9, 69 pp., 8 pl., 1933.

After pointing out the importance of spraying in the control of coffee diseases such as black rot (*Corticium koleroga*) [see next abstract], leaf disease (*Hemileia vastatrix*), and die-back, as well as insect infestation, the author describes a comprehensive series of experiments conducted in Mysore with various spray mixtures against *H. vastatrix* [*R.A.M.*, xii, pp. 435, 436]. From the results obtained it is concluded that the most suitable spray to use at present, when cost, safety in application, and efficiency are all considered, is Bordeaux mixture with lime-caseinate, which from the point of view of efficacy against *H. vastatrix* and crop yield gave better results than Burgundy mixture. Figures furnished by planters showed that the increase in crop yield that resulted from spraying in many instances ranged from 40 to 120 per cent., though the evidence indicated that where the average yields of unsprayed coffee are already as high as 5 cwt. per acre, the increase

of crop due to spraying will be less striking. During 1932 from 18,000 to 20,000 acres of coffee in Mysore State were sprayed, and the experience gained from the authors' own work is supplemented by much practical information from that of the planters.

Attention is drawn to the fact that by means of a simple appliance devised by the junior author the D.S.P. sprayer [loc. cit.] can be fitted with four lines of hose instead of two.

NARASIMHAN (M. J.). **Black rot of Coffee in Mysore.**—*Phytopath.*, xxiii, 11, pp. 875–886, 5 figs., 1933.

The examination of coffee leaves affected by black rot (*Corticium koleroga*) in Mysore, India [*R.A.M.*, x, p. 239], showed that the course of the disease can be divided into two distinct phases, namely, the early pellicle and late sclerotial, in the first of which a uniform white film covers the dorsal surface while the second is characterized by hyphal clumps scattered over the infected area, united by a slender mycelium.

The pellicle marking the incipient phase of black rot up to and including the sporing stage of the fungus is composed of a mass of interwoven hyaline threads with isolated primary strands consisting of a number of parallel hyphae [ibid., iii, p. 397]. 'Bridging hyphae' [ibid., xii, p. 777] form lateral unions between two main hyphae, but neither clamp-connexions nor anchor cells [ibid., iv, p. 67] were observed. The basidia appear at the ends of lateral branches and are not markedly clustered. Fully developed basidiospores from fresh material measured 9·1 by 3·4 μ, while the length of the sterigmata ranged from 5 to 11·5 μ. Both the spores and the hyphae resulting from germination are uninucleate, whereas after lateral fusions have occurred the newly formed hyphae are always binucleate. The sclerotial stage of black rot follows the sporing period and is characterized by a gradual change in the colour of the mycelium from white to fuscous, while the affected leaf turns rusty-brown. The sclerotia are formed by repeated branching of short, binucleate cells and eventually assume a pseudo-parenchymatous consistency; they serve to tide the fungus over the dry season. Only during the later, sclerotial stage of black rot has any evidence of leaf penetration by *C. koleroga* been observed. The hyphae emerging from the compact masses of pseudo-parenchymatous cells enter the leaf tissue through the stomata and penetrate the spongy parenchyma, often reaching the palisade cells.

The writer's investigations are stated to afford no evidence that the similar types of black rot affecting coffee in South America (such as the 'zilverdraadziekte' of Surinam and the 'candelillo' of Venezuela) [cf. also ibid., xi, p. 431] and other tropical countries are of different origin from the Mysore disease, though an exception may be made in the case of the Java cobweb thread blight with anchor cells [ibid., viii, p. 777].

PICADO (C.). **Colletotrichum des Caféiers et lésions radiculaires.** [The Coffee *Colletotrichum* and root lesions.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 8, pp. 268–270, 1933.

The author states that the two fungi associated with the disease

of the coffee bush recently described from Costa Rica [*R.A.M.*, xi, p. 369] have been identified by Wollenweber as a species of *Colletotrichum* forming perithecia of the *Glomerella cingulata* type, and *Fusarium lateritium* var. *majus*, respectively. He also gives a very brief outline of experiments which indicated that the primary cause of the disease is the species of *Fusarium* on the roots of the coffee bush, while the *Colletotrichum* sp. on the leaves is but a debility parasite.

Barducci (T. B.). **Un nuevo método para la determinación de 'la marchitez' o 'Cotton wilt' del Algodonero, el método de la hoja o 'Cotton wilt' leaf index.** [A new method for the diagnosis of Cotton wilt, the leaf method or 'Cotton wilt' leaf index.]—*Min. de Fomento, Direcc. de Agric. y Gan., Estac. Exper. Agric. de la Molina Circ.* 21, 15 pp., 1 col. pl., 4 figs., 1933.

A new method has been devised for distinguishing healthy cotton plants from those affected by wilt (*Fusarium vasinfectum*) in Peru [*R.A.M.*, xi, p. 225], where selection for resistance to this destructive disease has already resulted in the development of the Tangüis variety. If a large leaf, situated half-way up the stem of a normal plant, be detached, the almost triangular scar at the base of the petiole will appear transparent and entirely green, whereas in the case of wilt infection one or more brown spots will be observed, formed by infected vessels close to the central cylinder. This method has numerous advantages, being extremely accurate (in 96·21 per cent. of the 2,000 leaves examined), simple, convenient, and rapid in practice. It is advisable to test three leaves from each plant (from the upper, middle, and lower parts of the stem) in order to obtain absolute exactitude.

Rea (H. E.). **The effect of tillage on eradication of Cotton root rot.**—*Journ. Amer. Soc. Agron.*, xxv, 11, pp. 764–771, 1933.

Several tillage systems were compared for their relative efficacy in the control of cotton root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xii, p. 628] in widely separated sections of the Blackland Prairie region of Texas.

Although the stand of host plants of the fungus, e.g. *Physalis mollis* and *Ipomoea trifida*, was reduced in proportion to the intensity and duration of the tillage treatments, the reductions in the incidence of root rot during the course of the experiments were not consistently parallel with the decline in the numbers of perennial weed hosts. It was evident that only a small percentage of the infection surviving the more drastic tillage operations was carried over on the live roots of such plants. Sclerotia maturing before the effects of the treatments could operate are thought to have been largely responsible for the perpetuation of the disease on the trial plots.

Steyaert (R. L.) & Vrydagh (J.). **Étude sur une maladie grave du Cotonnier provoquée par les piqûres d'Helopeltis.** [A study on a serious disease of Cotton caused by the bites of

Helopeltis.]—Reprinted from *Mem. Inst. Roy. Col. Belge (Section Sci. Nat. et Med.)*, i, 7, 53 pp., 7 pl., 8 figs., 2 graphs, 1 map, 1933.

A detailed account is given of the authors' extensive investigation of a disease of cotton marked by the formation of numerous depressed black stem cankers which broke out with considerable severity at Kulu, Belgian Congo, in 1930, and reappeared a year later at Bomokandi and Bambesa. Experiments demonstrated that the disease, which was at first considered to be due to *Bacterium malvacearum*, had in fact resulted from injury by the mosquito bugs *Helopeltis bergrothi* and *H. sanguineus*, and the description of the effects produced by the insects on the stems indicates that there is a close similarity between these lesions and the cankers described by Smee and Leach on tea in Nyasaland as due to *H. bergrothi* [*R.A.M.*, xii, p. 332]. A few of the insects were observed in the course of these investigations to be parasitized by a species of *Sclerotium*, characterized by the formation of light to dark brown sclerotia, 48 to 100 μ in diameter, with a cortex of brown cells surrounding an inner hyaline, thick-walled pseudoparenchyma. In culture the sclerotia were up to 140 μ in maximum diameter.

Sawyer (W. H.). **The development of Entomophthora sphaerosperma upon Rhopobota vacciniana.**—*Ann. of Botany*, xlvii, 188, pp. 799–809, 2 pl., 1 fig., 1933.

This is a detailed account of the author's studies of the development of *Entomophthora sphaerosperma* [*R.A.M.*, xi, p. 371] in the tissues of *Rhopobota vacciniana* larvae infected with pure cultures of the fungus under controlled conditions at Harvard University. Conidia adhering to the surface of the insect were shown under favourable conditions to germinate in 90 minutes by the production of a germ-tube which penetrated the body wall by enzymic digestion in from 2 to 12 hours after germination; infection through the digestive tract was never observed. After penetration, the fungus grows rapidly in the blood, the circulation of which serves to distribute it throughout all the organs of the host, among which the fat-body and the oenocytes are disintegrated the most rapidly. Eventually all the internal organs are completely destroyed, until nothing remains of the original larva except the chitinous structures and the remnants of the food material ingested by the insect. As the available amount of nutrient substance diminishes in the last stages of host destruction, the fungus is stimulated to the production of hyphal bodies [ibid., viii, p. 719] by segmentation of its hyphae, this phase marking the end of its vegetative growth. The hyphal bodies either develop into a mass of internal resting spores, or give rise to conidiophores which burst through the cuticle, the life-cycle from inoculation to the production of conidia lasting on the average about 72 hours in small larvae.

The first signs of infection appear in the larva only after the disease is well established throughout its body, and are a change from a green to a yellowish colour, and restless movements, followed by sluggishness and increased turgor. The insect dies towards the end of the vegetative development of the fungus.

Morquer (R.) & de Boissezon (P.). **Étude biologique d'une association fongo-bactérienne chez la larve de Theobaldia annulata Sch. (Culicide).** [A biological study of a fungo-bacterial association in the larva of *Theobaldia annulata* Sch. (Culicidae).]—*Rev. Gén. de Botanique*, xlv, 539, pp. 537–574, 9 figs., 1933.

Larvae of the mosquito *Theobaldia annulata* reared in the laboratory showed a considerable mortality associated with a whitish fungal growth (in which bacteria also occurred) arising from the anal region. Two fungi were isolated from the mass and determined as *Penicillium palitans* (recorded for the first time in France) and *Botrytis cinerea* forma *theobaldiae* n.f. The parasitism of the latter was definitely established by inoculations of *Culex pipiens*, infection occurring only during the two initial larval stages, especially the first. *P. palitans* failed to infect *C. pipiens* and is considered to be a saprophyte, like the bacteria found associated with the fungi.

Benedek (T.) & Specht (G.). **Mykologisch-bakteriologische Untersuchungen über Pilze und Bakterien als Symbionten in Kerbtieren.** [Mycological-bacteriological investigations on fungi and bacteria as symbionts in Lecaniidae.]—*Zentralbl. für Bakt.*, Ab. 1 (*Orig.*), cxxx, 1–2, pp. 74–90, 7 figs., 1933.

Previous attempts at the cultivation of the symbionts of the Lecaniidae are stated to have given negative or inconclusive results, but the writers succeeded in culturing two organisms associated with *Lecanium corni* from *Spiraea opulifolia*, red currant, gooseberry, *Corylus avellana*, and vine. The so-called 'primary symbiont', occurring in every one of the 2,000 insects examined, is named *Torula lecanii corni* n. sp. [with a Latin diagnosis], and is characterized by hyaline, septate hyphae, 3·3 to 6·6 μ in diameter, and pale to olive-brown, mostly biscuit-shaped, unicellular, smooth conidia, 6·6 to 16·5 by 6·6 to 9·9 μ, the mycelial phase developing exclusively after the death of the host. The fungus grew well on Sabouraud's and Benedek's glucose agar and other nutrient media, its optimum temperature being from 15° to 27° C. The 'secondary symbiont', a sporogenous bacillus allied to *Bacillus megatherium*, was more sparsely represented.

Talice (R. V.) & Iruleguy (J. B.). **Parasitierende Pilze und Mykosen beim Menschen in Uruguay.** [Parasitic fungi and mycoses of man in Uruguay.]—*Arch. Urug. Med. Cir. y Esp.*, xi, 4, pp. 537–574, 1933. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cxii, 17–18, pp. 425–426, 1933.]

Human mycoses in Uruguay are divided on a clinico-etiological basis into five groups, viz., (I) dermatomycoses primarily affecting the epidermis, (II) blastomycoses, (III) sporotrichoses, (IV) aspergilloses and related skin diseases, and (V) actinomycoses and allied disorders. Annotated lists are given of the fungi responsible for Uruguayan mycoses under each of these groups.

Portugal (H.). **Einteilung der Hautmykosen.** [Distribution of the dermatomycoses.]—*Rev. Med.-Chir. Brasil*, xlii, 2, pp. 45–54, 1933. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cxii, 17–18, pp. 424–425, 1934.]

The dermatomycoses are divided into two main groups according to the site of infection, viz., true mycoses in which the fungus is to be found in the diseased area itself, and mycids [*R.A.M.*, xiii, p. 164] where the causal organism is situated in a part remote from that showing the symptoms. The mycoses are subdivided according to the epidermal, dermal, and deeper sites of infection.

De Almeida (F.). **As blastomycoses no Brasil.** [The blastomycoses in Brazil.]—*Ann. Fac. Med. São Paulo*, ix, pp. 69–163, 64 figs., 3 maps, 1933. [English summary.]

Chapter I of this comprehensive study of the Brazilian blastomycoses deals with the definition and classification of the blastomycoses, while each of the ten following chapters is devoted to one of the causal organisms, viz., *Candida albicans*; *C. butantanensis*, isolated by J. M. Gomes in 1924 (under the name of *Monilia butantanensis* n. sp.) from a pulmonary lesion simulating tuberculosis; *Neogeotrichum pulmoneum*, originally detected in 1912 by O. Magalhães as an agent of pulmonary mycosis; *Torulopsis* or *Mycoderma* [*Endomyces*] *dermatitidis* (syns. *Blastomyces dermatitidis* Gilchr. & Stokes, *Cryptococcus dermatitidis* Cast., &c.) [see next abstract]; *Proteomyces infestans*, isolated and described by Moses and Vianna in 1913 from a single case of human mycosis; *Coccidioides immitis*, which is studied in detail from the morphological, physiological, and clinical standpoints; *Pseudococcidioides mazzai*, believed by F. P. Almeida to be identical with the foregoing [ibid., xi, p. 782]; *Paracoccidioides brasiliensis* [ibid., x, p. 310], the differences between which and *C. immitis* are indicated on the basis of comprehensive studies; *Rhinosporidium seeberi* [ibid., xii, p. 568], of which only one case appears to have been reported from Brazil; and *Trichosporium* or *Acrotheca pedrosoi*, responsible for chromoblastomycosis [ibid., xi, p. 645 and next abstract].

Ota (M.) & Kawatsure (S.). **Zur Ätiologie der echten und falschen Blastomykosen, besonders der Gilchristschen Krankheit.** [On the etiology of the true and spurious blastomycoses, especially of Gilchrist's disease.]—*Arch. für Dermatol.*, clxix, 2, pp. 149–172, 11 figs., 1933.

An attempt is made to define the obscure position occupied in the dermatomycotic branch of medicine by the true and spurious blastomycoses. True blastomycoses are those evoked by ascogenous or anascogenous yeasts, the former represented by *Saccharomyces*, *Debaryomyces*, and *Willia* spp., as human pathogens, while opinions are divided on the classification of the latter. The writers consider that those species forming no mycelium should be referred to the genus *Torulopsis* Berlese [*R.A.M.*, xi, p. 642].

The so-called oidiomycoses, often known as blastomycoses, are etiologically divergent conditions. 'Gilchrist's disease' or American blastomycosis, commonly placed in this group, is caused by two

fungi, namely *Aleurisma tulanense* Castellani, 1926 (syns. *Rhinotrichum* sp. Ota, 1925, *Blastomycoides tulanensis* Cast., 1926 [ibid., xii, p. 171], *Glenospora gammeli* Pollacci et Nannizzi, 1927, *Acladium gammeli* Ota, 1928, and probably *Blastomyces* [*Endomyces*] *dermatitidis* Gilchr. and Stokes [ibid., xiii, p. 95 and preceding abstract] and a number of others), and *Scopulariopsis americana* Ota, 1926 [see next abstract]. Agostini's determinations of *Geotrichum immite* (*Blastomycoides immitis*) and *Monosporium tulanense* (*B. tulanensis*) [ibid., xii, p. 171; xiii, p. 162] are not accepted by the writers. The pathological conditions simulating blastomycosis caused by species of *Geotrichum* (*Oidium* or *Mycoderma*) and *Trichosporon* (*Geotrichoides*) must not be confused with true blastomycosis or with Gilchrist's disease.

The taxonomic position of *Coccidioides immitis* [ibid., xiii, p. 30] is hard to define, but it would seem, from the writers' and da Fonseca's and Leão's studies to approximate closely to *Protomyces*. The unsuitably named 'chromoblastomycosis' may be due either to *Phialophora verrucosa* or *Trichosporium pedrosoi* [ibid., xi, p. 645; xii, p. 370, and preceding abstract].

Kawatsure (S.). **Tierexperimentelle Untersuchungen über die Erreger von sogenannten amerikanischen Blastomykosen: Scopulariopsis americana, Aleurisma tulanense und Coccidioides immitis.** [Experimental studies on animals with the agents of so-called American blastomycoses: *Scopulariopsis americana*, *Aleurisma tulanense*, and *Coccidioides immitis*.] —*Arch. für Dermatol.*, clxix, 2, pp. 173–199, 11 figs., 1933.

Full clinical details are given of the pathological changes induced in laboratory animals by inoculation with *Scopulariopsis americana*, *Aleurisma tulanense* [? *Endomyces dermatitidis*], and *Coccidioides immitis* [see preceding abstract]. All the organisms produce in the lungs, spleen, and other internal organs tuberculoid nodules with a caseous central abscess surrounded by granular tissue and numerous epithelioid cells, frequently also by giant cells (less conspicuous in the lesions caused by *A. tulanense*), which in turn are encircled by connective tissue of varying thickness. *S. americana* and *A. tulanense* develop in the granulomata as spherical yeast forms, 10 to 16 μ in diameter, generally composed of three layers, the outermost a well-defined membrane, the intermediate a poorly staining circular zone, and in the centre a roundish mass of protoplasm. At this stage the differentiation of the two species is difficult. Both are involved in the causation of 'Gilchrist's disease', the classical descriptions of which, however, have most likely been based on *S. americana*, the more virulent of the two parasites. The lesions produced by *C. immitis* may usually be recognized by the occurrence of the fungus in the shape of spore cysts, 20 to 40 μ or more in diameter, but occasionally this species is also represented by smaller yeast-like forms, about 10 μ in diameter, which complicate identification. Still smaller forms (5 μ in diameter) may be detected in the lung nodules, probably endospores liberated from the cyst membrane. The prognosis of *C. immitis* is much graver than that of the other two fungi under discussion.

Ciarrocchi (L.). **Onicomicosi da Mycotorula.** [Onychomycosis due to *Mycotorula.*]—*Giorn. Ital. di Dermatol.*, lxxiv, 2, pp. 415–429, 3 pl., 1933.

Full clinical details are given of a case of paronychia and onychia of both hands in a 22-year-old female domestic servant in Rome. The fungus isolated from the diseased scales on Sabouraud's agar at 16° to 20° C. formed creamy, thick, smooth, whitish to yellow, radiating colonies, and was characterized by a hyaline pseudomycelium composed of segments measuring 30 to 60 by 3·5 μ, from the upper ends of which were budded off hyaline blastospores, which were either globular (4 μ in diameter) or elliptical (4·5 by 3 μ) and were sometimes guttulate. Globose, hyaline chlamydospores (6 to 7·5 μ in diameter) were also formed. The organism, which was pathogenic to laboratory animals, is classified [with a Latin diagnosis] as *Mycotorula onychophila* n. sp., and in this connexion a brief review is given of the systematic position of the yeast-like fungi [cf. *R.A.M.*, xiii, p. 186].

Weidman (F. D.). **Cutaneous torulosis: the identification of yeast cells in general in histologic sections.**—*Southern Med. Journ.*, xxvi, 10, pp. 851–863, 14 figs., 1933.

In this paper the writer enumerates and analyses the meagre clinical data on cutaneous torulosis of man and the monkey *Macacus rhesus*, and describes at some length his observations on (1) its pathological histology; (2) experimental reproduction in animals; (3) the morphology of the organism, which was identified as *Torula histolytica*, in pus; and (4) the cultural characters of the fungus.

Extremely minute yeast cells preponderated in the lesions, but a number of giant forms 10 to 15 times the diameter of the foregoing and producing linear and lateral chains of buds, were also observed. Mycelial formation was not detected. The organism grew well on Sabouraud's and other standard media between P_H 5·8 and 8·6, forming heaped, glistening white or creamy, later brown, watery colonies. The capacity of *T. histolytica* for fermenting carbohydrates is practically nil; acid was produced in glucose and levulose by all the 19 strains from cerebrospinal cases used in the tests, but as great irregularity in respect of other sugars was shown by the various strains, it is thought that differences in acid production are not sufficiently reliable for specific differentiation. The organism proved resistant to gentian violet at a concentration of 1 in 1,000. Mice and rats were more susceptible to artificial infection than guinea-pigs and dogs.

Cremer (G.). **Untersuchungen über die Epidermophytie der Füsse und Hände in Amsterdam.** [Investigations on epidermophytosis of the feet and hands in Amsterdam.]—*Arch. für Dermatol.*, clxix, 2, pp. 244–258, 6 figs., 1933.

The results of an examination of 75 patients suffering from epidermophytosis of the feet and hands at the Amsterdam University Skin Clinic confirmed the views of Jadassohn and Peck with regard to the spread of infection to the hands in the form of dysidrotic eruptions (epidermophytids) [*R.A.M.*, ix, p. 383; xiii, p. 164].

The organism responsible for the condition in the feet was usually a yellowish-white *Epidermophyton* differing from the common variants of Kaufmann-Wolf's fungus, possibly through pleomorphic degeneration; *E. inguinale* [*E. floccosum*: ibid., xii, p. 630] was only isolated once.

Schmidt (P. W.). **Zur Pathogenese der Epidermophytien und Trichophytien der Hände und Füsse unter besonderer Berücksichtigung der ekzematoiden Hautveränderungen mit Kulturergebnissen in 732 Fällen.** [On the pathogenesis of the epidermophytoses and trichophytoses of the hands and feet with special consideration of the eczematoid skin changes, with cultural results in 732 cases.]—*Arch. für Dermatol.*, clxix, 2, pp. 259–294, 9 figs., 1933.

At the Münster (Westphalia) University Skin Clinic fungous diseases constitute 10 per cent. of the total cases examined [*R.A.M.*, xii, p. 444], in half of which the hands and feet are involved. The last few years have been marked by a gradual increase of these diseases. Fungi were isolated from 73 per cent. of the 243 cases of dysidrotic and squamous conditions of the feet. The designation 'dysidrotic' should be replaced, in the writer's opinion, by the term 'pseudo-dysidrotic'. The Kaufmann-Wolf *Epidermophyton* [see preceding abstract] developed in over 77 per cent. of the cultures, *E. inguinale* [*E. floccosum*] in 19 per cent., and *Trichophyton cerebriforme* and *Achorion quinckeanum* [see next abstract] in 2·4 per cent. In two cases of generalized epidermophytosis, starting from the feet, Kaufmann-Wolf's fungus and *E. floccosum*, respectively, were isolated from the pityriasis-like areas on the body and upper arm, to which the organisms were probably conveyed by the blood stream. Fungi were isolated from 23·4 per cent. of the 469 cases of epidermophytosis of the hands, Kaufmann-Wolf's fungus being obtained in 60 per cent., and *E. floccosum* in 11 per cent., while 28 per cent. yielded *T. rosaceum*, *T. gypseum asteroides* [*T. mentagrophytes*], *T. cerebriforme*, *T. acuminatum*, *A. quinckeanum*, or *A. schoenleini*.

The clinical and etiological aspects of these conditions are very fully discussed.

Beintema (K.). **Klinische und kulturelle Beobachtungen bei Achorion quinckeanum.** [Clinical and cultural observations on *Achorion quinckeanum*.]—*Dermatol. Zeitschr.*, lxviii, 1–2, pp. 21–27, 3 figs., 1933.

Favus caused by *Achorion schoenleini* is stated to be very prevalent in Holland, whereas, during the last six years, *A. gypseum* [*R.A.M.*, xi, pp. 575, 645] was only once isolated and *A. quinckeanum* [ibid., xii, p. 444 and preceding abstract] seven times. The last-named was twice isolated from scalp hair (stated to be a very rare site) which showed the clinical picture of a kerion celsi, with incipient hyphal and spore formation on the exterior of the hairs.

Attention is drawn to the disappearance of the spindles from cultures of *A. quinckeanum* and their replacement by rows of chlamydospores, as well as to the occurrence of pleomorphism on thin or desiccated media.

Dessy (G.). **La chimiothérapie des mycoses. IIIème Partie: Mucoromycose. IIème Communication: expériences 'in vivo'.** [The chemicotheraphy of mycoses. Third Part. Mucormycosis. Second communication: experiments '*in vivo*'.]—*Boll. Sez. Ital. della Soc. Internaz. Microbiol.*, v, 9, pp. 201–206, 1933.

Continuing his investigations [*R.A.M.*, xii, p. 693] the author conducted experiments *in vivo* to ascertain the therapeutic power of brilliant green, methyl violet, malachite green, copper sulphate, nickel chloride, and cobalt chloride in an experimental infection of rabbits with *Mucor pusillus*, a fungus known to be constantly a strong rabbit pathogen. The results obtained showed that these substances when introduced into the veins exercised no chemicotherapeutic action against this fungus.

Tschernjak (W. S.). **Die Schimmelpilzmykose des Magens bei Schweinen.** [Gasteromycosis in pigs.]—*Zeitschr. für Infektionskrankh. &c. der Haustiere*, xlv, 1, pp. 72–73, 6 figs., 1933.

Full particulars are given of two cases of gasteromycosis (stated to be a very rare condition) in young pigs at Woronesh, U.S.S.R., the fungus isolated from both animals being characterized by a densely woven mycelium consisting of branched hyphae, 5 to 8 μ in thickness, with clavate swellings at the tips, staining only with haematoxylin-eosin. No spores were observed and cultures could not be obtained, but the organism is tentatively identified as a *Mucor*. Peculiarities of the first case under observation were the mass of giant cells (up to 300 μ in diameter) by which the fungus was ingested (phagocytosis), the penetration of the organism into the vessels, and gas formation. The gastric lining of both animals was completely necrosed.

Van Beyma Thoe Kingma (F. H.). **Ein unbekanntes pathogenes Cephalosporium, Cephalosporium stühmeri Schmidt et van Beyma.** [An unknown pathogenic *Cephalosporium, Cephalosporium stühmeri* Schmidt et van Beyma.]—*Zentralbl. für Bakt.*, Ab. 1, cxxx, 1–2, pp. 102–105, 3 figs., 1933.

A species of *Cephalosporium* differing considerably from the only other representative of the genus recorded as a human pathogen, namely, *C. acremonium* [*R.A.M.*, xii, p. 290; see also xii, p. 511], was isolated from two cases of dermatomycosis, one involving the scalp and the other the hand. A fair degree of similarity with the entomogenous fungus, *C.* (*Acrostalagmus*) *coccidicolum* [ibid., v, p. 97], was shown, but the colony types of the two organisms on Raulin's and beerwort agar are sufficiently distinct to justify their separation. The fungus was described by P. W. Schmidt, of the Skin Clinic of Münster University, Westphalia (where the cases were treated by Prof. Stühmer) and stated by him to agree with one independently recognized as a new species of T. Benedek [ibid., xii, p. 444]; it is accordingly named *C. stuehmeri* Schmidt & van Beyma, a diagnosis in German being supplied.

The greyish-white to light brown, densely matted, radially furcate mycelium, of a somewhat floury consistency, is composed of

sparsely septate hyphae, 2 to 3·3 μ in diameter (up to 6 μ in old cultures); the straight, non-septate, unbranched conidiophores are 30 to 40 μ long, 2 μ wide at the base, tapering towards the apex, where the hyaline, oval to ellipsoid conidia, 3 to 6 by 1·7 to 2·3 μ (average 3·3 by 2 μ) are abstricted in masses to form a 'head' 10 to 15 μ in diameter.

DEY (P. K.). **An Alternaria blight of the Linseed plant.**—*Indian Journ. Agric. Sci.*, iii, 5, pp. 881–896, 2 pl., 1 fig., 1933.

Linseed (*Linum usitatissimum*) in waterlogged fields in the United Provinces, India, has been observed to suffer heavy damage from an apparently new species of *Alternaria* for which the name *A. lini* is proposed [with an English diagnosis]. Losses ranging from 27·9 to 59·6 per cent. of the crops were calculated at the Cawnpore and Gorakhpur Experimental Farms in 1933. The fungus attacks all the aerial organs of the plants, especially the buds, flowers, and upper leaves, the first symptom being the failure of the flowers to open during the day. Minute, dark brown spots appear near the base of the calyx, over which they gradually extend, passing into the pedicel and causing the decay of the inflorescences. The young leaves were invaded from the base, whence the organism also passed into the stem, producing wilting and distortion. Older leaves were usually infected at the tips. In severe cases, associated with very humid conditions, the whole plant shrivelled. The pods, if formed at the time of infection, were invaded similarly to the flowers.

A. lini was readily obtained in pure culture. The hyaline, sparsely septate hyphae measured 2 to 7·5 μ (average 4 μ) in breadth, the conidiophores 2·5 to 4·5 μ (3·5 μ), and the concatenate, dark olive (sooty-black in the mass), flask-shaped, echinulate (except the beak cell), mostly triseptate conidia 24 by 7 μ including the beak cell, the average length of which was 4·9 μ. The conidia are produced by acropetal fragmentation of the conidiophores. In infection the conidia attach themselves to the host surface by means of mucilage developing on their exterior on wetting, assisted by the spines. The apical growth of the germ-tubes, also adhering by their mucilaginous sheath, causes the rupture of the cuticle by mechanical pressure [*R.A.M.*, xii, p. 566].

Inoculations on healthy cut branches of linseed at 74° to 85° F. resulted in a destructive rotting, the symptoms of which agreed with those observed in nature. The only control measures likely to be practicable are the choice of high, well-drained sites and the cultivation of late linseed varieties.

RAMOS (M. M.). **Mechanical injuries to roots and corms of Abacá in relation to heart-rot disease.**—*Philipp. Agric.*, xxii, 5, pp. 322–337, 1933.

Heart rot of abacá (*Musa textilis*), identified by the browning of the youngest furled leaf and blackening of the centre of the pseudostem, has been found by the writer in the Philippines to occur primarily as a sequel to the combined effects of infestation by the weevil *Cosmopolites sordidus* and the virus disease bunchy top [*R.A.M.*, xi, p. 300]. From 10·49 to 22·1 per cent. of the

plants affected by the latter condition died of heart rot in the course of the present investigations on 1,000 plants, while the incidence of the disease following weevil injuries ranged from 53·3 to 90 per cent., the corresponding figures for nematodes (*Heterodera radicicola*) being 9·5 to 20·5 per cent. Root injury was found sometimes to result in the development of the disease. The fungus isolated from heart-rot material caused heart rot in potted abacá seedlings only under damp-chamber conditions and the plants recovered when placed out of doors; it was identified as *Fusarium moniliforme* var. *subglutinans* [ibid., iv, p. 569], full morphological and cultural details being given. It is concluded that heart rot may be regarded as a secondary trouble, developing only on plants weakened from some other cause.

PALM (B. T.). **The gametophytes in a composite affected with 'Aster-yellows'.**—*Svensk Bot. Tidskr.*, xxvii, 4, pp. 420–437, 6 figs., 1933.

No abnormalities were observed in the development of the anthers, tapetal and sporogenous tissues, and male gametophytes of *Troximon glaucum* plants spontaneously affected by aster yellows [*R.A.M.*, xii, p. 446] in Colorado and showing symptoms of stunting, bronzing of the leaves, and proliferation of the floral organs similar to those known in *Aster sinensis* [*Callistephus chinensis*]. In the ovules of these plants, however, the development of the sporogenous cells is delayed or inhibited, while other abnormal features include elongation and flattening of the funiculus and imperfect growth of the integument. The female gametophyte appears to undergo final degeneration at the binuclear stage of the embryo sac, which is formed from a chalazal megaspore. Complete and persistent sterility of the ovule (precluding seed transmission of the disease) is thus effected. Numerous hairs are present in the ovular cavity arising from the epidermis of the placenta, whereas in normal plants no hairs develop near the ovule. The theoretical possibility is suggested that the pollen from an infected plant may convey the virus to the embryo sac of a healthy one in the process of fertilization.

VALLEAU (W. D.), FERGUS (E. N.), & HENSON (L.). **Resistance of Red Clovers to Sclerotinia trifoliorum Erik., and infection studies.**—*Kentucky Agric. Exper. Stat. Bull.* 341, pp. 115–131, 1 fig., 1933.

After an exceptionally mild winter in central Kentucky crown rot (*Sclerotinia trifoliorum*) infection was prevalent in the spring of 1932 throughout 78 plots of one-year-old red clover (*Trifolium pratense*) from various localities at Lexington. Counts of apothecia on the infected area averaged 26·4 per sq. ft. or 1,149,984 per acre. The local Kentucky clover averaged 71 per cent. plants unaffected, as compared with only 26·6 per cent. unaffected plants among the foreign clovers; an English strain had only 13 per cent. unaffected plants, while Tennessee clover was rather less resistant than that from Kentucky. Apparently, a relatively high resistance results from continuous selection made locally over a period of years. By the spring of 1933 only the Kentucky plants were still alive.

When autumn-sown, however, clover adapted to the local conditions appeared to be no more resistant than the unadapted clovers. When dependent upon dead plant material for subsistence the fungus rapidly declined in activity, and it is considered that a saprophytic stage, if it exists, must be subsidiary to the parasitic stage and has little practical significance as a source of infection [cf. *R.A.M.*, viii, p. 793].

In new plantings wind-blown ascospores probably constitute the usual form of infection. Isolations from spots found in autumn on leaves and petioles yielded pure cultures of *S. trifoliorum*, and when apothecia were placed under bell-jars with greenhouse-grown red clover similar spots developed from which the organism was again isolated. *S. trifoliorum* may remain alive in leaf spots as long as the leaves live, and when they die the fungus spreads into the petioles and thence to the crowns. Infection of green leaves is the principal means by which the organism is carried over from the time of spore discharge until weather conditions and host susceptibility enable crown rot to develop.

In point of inherent resistance adapted clovers do not differ from unadapted, but they are hardier and develop more normally so that they possess a fluctuating physiological resistance as distinct from one depending on permanent genetic factors. The evidence obtained indicated that clover tissues produced during warm periods are highly resistant to *S. trifoliorum*, while those produced in cold weather are more susceptible, especially if the variety is unadapted to local conditions. There was no indication of the occurrence of physiologic forms of the fungus.

For the most part, winter and spring attacks of *S. trifoliorum* can be correlated with the production in autumn of most of the apothecia. Apothecia found occasionally in the field in spring, however, are believed to have originated from sclerotia of the second preceding season. Experiments indicated that part of the spring infection in Kentucky results from these spring apothecia.

S. trifoliorum was also found on *Plantago lanceolata* and *Chrysanthemum cinerariaefolium*.

From a detailed study of the literature the suggestion is made that *S. minor* Jagger [ibid., viii, p. 607] and *S. trifoliorum* are identical, the former occurring on a host (usually lettuce), not commonly recognized as a host of the latter.

A bibliography of 15 titles is appended.

WEIMER (J. L.). **Effect of environmental and cultural factors on the dwarf disease of Alfalfa.**—*Journ. Agric. Res.*, xlvii, 6, pp. 351–368, 3 figs., 1 diag., 1933.

The results of experiments started in 1929 at the Riverside, California, experimental farm showed that the development of the dwarf disease of lucerne recently described from that State [*R.A.M.*, x, p. 388] is markedly promoted by high soil moisture, plots which were irrigated twice monthly during the growing season and cut regularly for hay, becoming practically worthless by the middle of the fourth year of cultivation, while similar plots left without irrigation during the seed-growing period retained

a fair density of stand by the end of the fourth year. Cutting the lucerne in the unopened flower bud stage appeared to hasten slightly the thinning-out effect of the disease, but not to any commercially significant extent. Seasonal temperature also appeared to have a certain bearing on the development of the trouble, but is not believed to be a factor in limiting the latter to the regions in which it exists at present. No relationship could be established between the severity of the disease and type and fertility of soil or the presence or absence of any of its common mineral elements, and the addition to the soil of different fertilizers failed to check the disease and to prolong the life of the lucerne stands. The investigation also indicated that dwarf is largely responsible for the rapid dying of lucerne plants in southern California.

Bennett (F. T.). **Fusarium patch disease of bowling and golf greens.**—*Journ. Board Greenkeeping Res.*, iii, 9, pp. 79–86, 1933.

Good control of *Fusarium nivale* (*Calonectria graminicola*) on the grasses of a golf green (*Agrostis stolonifera* var. *alba*, *A. tenuis*, *Poa annua*, *Festuca rubra* var., *F. ovina* var., and *Lolium perenne*) [*R.A.M.*, xi, p. 246; xii, p. 754] in the north of England was obtained by regular applications (twice weekly for three weeks before the opening of the playing season, and once a week from May to September) of a combination of Bordeaux mixture and malachite green [ibid., xii, p. 371] at the rate of $3\frac{1}{4}$ galls. per 150 sq. yds. Laboratory experiments showed that malachite green was completely inhibitory to the growth of *F. nivale* at a strength of 1 to 20,000. The total cost of the combination [full directions for the preparation of which are given] is estimated at £3 10*s.* for a sufficient quantity for nine months' treatment of a green 42 by 42 yds., exclusive of labour, each application occupying one man for four hours.

Suit (F. R.). **Pseudomonas rhizogenes R.B.W.K. & S.; its host relations and characteristics.**—*Iowa State Coll. Journ. of Sci.*, viii, 1, pp. 131–173, 6 pl., 1 graph, 1933.

Infectious hairy root (*Pseudomonas* [*Bacterium*] *rhizogenes*) [*R.A.M.*, x, p. 166; xi, p. 561] was found present on all of 20 varieties of nursery apple trees examined in five States in North America, the percentage of infection ranging from 1·7 on Delicious trees in Kentucky to 45·2 on Wealthy in Oklahoma. A higher percentage of infection was observed in Kansas and Oklahoma than in Iowa, Kentucky, or Nebraska; the organism occurred most commonly on Wealthy, Yellow Transparent, and Duchess, and was only occasionally found on Jonathan, Delicious, and Stayman.

Bact. rhizogenes induced three forms of abnormal root development: an abundance of fleshy roots (the symptom in the first growing season), hairy or woolly knot (one-year-old hairy root), and clusters of small rootlets on the aerial parts.

The organism was isolated from hairy root on nursery stock of *Spiraea vanhouttei* and *S. prunifolia*, and also from the Flori-

bunda crab-apple (*Pyrus pulcherrima*), but not from the similar condition found on *Lonicera tartarica* and *Symphoricarpos racemosus*. Inoculations gave positive results on sugar beet, tomato, *Chrysanthemum frutescens*, *Bryophyllum calycinum*, *Phaseolus vulgaris*, *Coleus blumei*, apple, *S. vanhouttei*, *L. tartarica*, *S. racemosus*, *Gleditschia triacanthos*, mulberry, peach, *Caragana arborescens*, *Elaeagnus angustifolia*, and *Cotoneaster acuminata* seedlings.

No definite relation was established between host acidity and susceptibility. *Bact. rhizogenes* caused the medium to become acid when lactose, maltose, galactose, xylose, arabinose, or levulose was used as a source of carbon, and can be distinguished from *Bact. tumefaciens* by this means. A table is given showing the differences between these two species. In the field the formation of hairy root on inoculated apple grafts and peach seedlings was influenced more by rainfall than by soil temperature or time of season.

The evidence obtained showed that the most effective way of reducing hairy root on piece-root-grafted apple trees of the varieties studied was by making wedge-grafts and wrapping them with adhesive tape.

A bibliography of 23 titles is appended.

GROVES (A. B.). **A study of the sooty blotch disease of Apples and the causal fungus Gloeodes pomigena.**—*Virginia Agric. Exper. Stat. Tech. Bull.* 50, 43 pp., 10 pl., 3 figs., 1933.

In his investigation, started in 1929, of sooty blotch (*Gloeodes pomigena*) of apples [*R.A.M.*, xii, p. 517] collected from various parts of the United States, the author established the existence of marked differences between many of the specimens both on the fruit and when isolated in pure culture. A closer study of some 180 isolations [the results of which are presented in the form of tables and illustrated by numerous photographs] showed that morphologically the thalli may be grouped arbitrarily into four main types, the distinction between which is not rigid nor based on fundamental characters. These four types are fully described and named, respectively, ramose or peniculate (with much branched thalli); fuliginous (thalli which appear as smoky or sooty smudges); punctate (thalli whose large, conspicuous plectenchymatal bodies give them a distinctly punctate appearance); and rimate (thalli that cause a more or less conspicuous roughening of the apple cuticle). The thalli of the ramose type constituted about 80 per cent. of all those observed. These types do not represent different stages in the development of the fungus, but remain typically constant throughout their growth both on the fruit and in culture. Frequently more than one group may appear on a single fruit, often actually joining, so that thallus variations cannot be a matter of varietal influence from the host nor a response to environmental conditions.

Physiological tests of 30 isolants [isolated by a method which is described in detail], selected because of the visible differences they exhibited, showed that none of them reacted to changes in the

culture media used entirely in the same way as any of the others, but the existence of any definite relationship between thallus type on the apple and differences shown by the isolants in culture could not be established.

In the course of his investigation the author observed several cases of actual disruption of the apple cuticle by the fungus, the initial penetration appearing to be effected by means of a multicellular peg-like structure formed usually under heavy aggregations of mycelium or under the plectenchymatal bodies. The degree of cuticle disruption varies considerably, and the thalli may be separated from this standpoint into three groups, namely, those that penetrate the cuticle by means of the peg-like structure, grow and ramify throughout a few cells near the initial point of penetration, and cause little or no externally visible effect on the fruit; those that make a considerable growth within the epidermal region which is extensively disrupted, all evidence of the penetrating peg being obscured by the large amount of mycelium present; and those that form a more or less extensive ramification chiefly within the intra-cuticular region, although the fungus may at times penetrate further into the fruit. In every case, the organism appears to derive nutritive substances largely from the region of its heaviest growth, and also from the cuticle itself, at least for some time. It was clearly established that the fungus frequently passes right through the cuticle and often enters the epidermal cells. Considerable growth may occur either entirely beneath the cuticle or in the intra-cuticular region. The production of cork cells by the host is often stimulated. These observations are considered to indicate the active though limited parasitic nature of *G. pomigena*.

Ogilvie (L.). **Canker and die-back of Apples associated with Valsa ambiens.**—*Journ. Pomol. and Hort. Science*, xi, 3, pp. 205–213, 1934.

A brief account is given of a die-back of apples which is stated to have been very frequent in the west of England in 1930, and which is considered to have been associated with the exceptionally wet preceding winter. The affected trees bore ascending, wedge-shaped cankers at their base, on which fructifications of a *Cytospora* appeared, and this fungus was also obtained from small cankers on the branches, associated with various forms of injury. Pure cultures of this organism inoculated into healthy apple twigs failed to cause infection, but when a small area of the twigs was slightly charred prior to inoculation, the fungus penetrated several inches into the healthy wood and typical cankers were produced, on which pustules of the fungus developed, followed by the perithecia of *Valsa ambiens* [*R.A.M.*, xi, p. 41]. Single-spore cultures of the latter reproduced *Cytospora* pycnidia with the typical yellow spore tendrils, identical with the fungus isolated directly from cankers. This was determined as *C. ambiens* Sacc. A brief description of both stages is appended.

In reviewing previous references to *V. ambiens* in England, and similar diseases of other host plants associated with species of *Valsa* and *Cytospora*, the author considers that *V. ambiens* is a

weak parasite capable, when established in necrotic areas, of invading healthy tissue to a limited extent.

URBÁNYI (J.). **Fagyás, baktérium, penészgomba, vagy 'majfoltosság'-e az, ami az elraktarozott Almákat károsítja?** [Has the damage observed on stored Apples been caused by frost, bacteria, mould fungi, or 'freckle'?]—*Kisérletügyi Közlemények*, xxxvi, 1–3, pp. 163–171, 7 figs., 1933. [English, Italian, and French summaries.]

Attention is drawn to a severe outbreak of 'freckle' or scald [*R.A.M.*, xiii, p. 108] among stored apples in Hungary in 1932. The chocolate-coloured spots were equally prominent in the green and red parts of the fruit, and on the portions exposed to the sun or protected from it. The smaller lesions were generally limited to the epidermis or the immediately underlying tissues of the rind, while the larger ones penetrated the flesh. The reaction of the different apple varieties to the disorder was quite inconsistent, Jonathan and White Winter Tafota, for instance, being healthy in one locality and heavily damaged elsewhere; other varieties developing scald included the Cassel and Ribston Pippins. The continuously hot, dry weather prevailing during the harvest season is believed to have played a part in the disturbance, which detailed investigation showed was not associated with any parasitic organism. It is considered to be a form of scald.

DILLON WESTON (W. A. R.) & PETHERBRIDGE (F. R.). **Apple and Pear scab in East Anglia.**—*Journ. Pomol. and Hort. Science*, xi, 3, pp. 185–198, 2 pl., 1933.

As a result of spore-trapping experiments in 1932 in the eastern counties of England, the ascospores of *Venturia inaequalis* and *V. pirina* [*R.A.M.*, xiii, pp. 34, 36] were shown to play no part in the early infections of apple and pear trees with scab, which take place before blossoming, since the first ascospores of both fungi were trapped in or near the trees at the end of April and beginning of May, when primary infections by conidia were already well established on the trees. As indicated by field observations, the main source of the early infections was the common presence on the one-year-old fruit spurs and non-fruiting wood of pustules of the fungi, which were found producing conidia very early in the season. In a separate set of experiments it was shown that the conidia are chiefly distributed in splashes of rain, although infection of the developing buds by direct contact with pustules on the one-year-old wood was also observed in some cases. Aphids are also a contributing factor in the spread of infection, since they were shown to carry the conidia of both organisms attached to the hairs on their legs.

A few details are also given of spraying experiments, the results of which showed that scab was more readily controlled, when only one pre-blossom lime-sulphur spraying, in addition to the two post-blossom, was given, on apple varieties that are not susceptible to wood infection (e.g., Blenheim Orange) than on those whose wood is susceptible (Cox's Orange and Worcester Pearmain).

Copper oil Pear wrap to be used.—*Better Fruit*, xxviii, 4, p. 5, 1933.

Anjou pears dispatched from Washington and Oregon are stated to be packed by progressive growers in a special copper oil wrap, known as the 'Hartman wrap', which is claimed effectively to prevent scald and the disease known locally as 'nest rot' or 'grey mould' [*Botrytis ?cinerea*: *R.A.M.*, xi, p. 115] on this variety, even if the fruit is packed wet. The wrap is prepared from a basic copper sulphate impregnated in the pulp as the paper is made. Anjou pears so wrapped during transit remain free from both diseases even after being unwrapped for sale.

Willison (R. S.). **Peach canker investigations. 1. Some notes on incidence, contributing factors, and control measures.**—*Scient. Agric.*, xiv, 1, pp. 32–47, 1 diag., 7 graphs, 1933. [French summary on p. 52.]

This is a detailed report of experiments from 1928 to the end of 1932 carried out in an experimental peach orchard at St. Catharine's, Ontario, the results of which established the preponderating part played by various traumatic lesions of the bark and by dead stubs following careless pruning and dead twigs such as result from 'die-back' as points of origin for the development of peach cankers [*R.A.M.*, xi, p. 249]. A smaller proportion of the cankers was found to have originated from injuries following *Verticillium* wilt, winter injuries to the collar, dead buds, and broken or split branches. The chief significance of the brown rot fungus [*? Sclerotinia fructicola*: ibid., xiii, p. 33] as a cause of canker is indirect and due to the fact that some of the lesions which it produces on the twigs and branches following blossom and fruit infections may serve as points of entry for canker-producing organisms, e.g. *Valsa* (*Cytospora*) *leucostoma* [ibid., xi, p. 790; xiii, p. 39].

Experiments indicated that while treatment by spraying is effective against brown rot of the fruit and the twig infections associated with it, it apparently does not control the development of the cankers. There was also experimental evidence that peach trees which are overstimulated by cultural practices, with the result that the current year's growth is not sufficiently mature at leaf fall, are more subject to canker than thrifty trees which mature normally. There was some indication of differences in varietal susceptibility among the ten varieties of peach which were tested, but this question needs further investigation.

The paper terminates with recommendations for the prevention of canker, among which special stress is laid on the necessity of a thorough sanitation of the orchards and of the individual trees. Pruning should not be done during the dormant season, but early in the growing season, and may be deferred until late March or April, since pruning wounds made in the spring are less liable to be cankered than the winter ones [cf. ibid., v, p. 503]. Large pruning wounds and cankers, after cleaning, may be disinfected with 1 in 500 mercuric chloride solution and covered with a protective such as white lead paste free from turpentine and with no excess of oil.

SEIDEL (K.). **Zum Kampf gegen Monilia an Sauerkirschen.** [Towards the campaign against *Monilia* on sour Cherries.]—*Obst- und Gemüsebau*, lxxix, 11, p. 174, 1933.

The writer has observed that *Monilia* [*Sclerotinia cinerea*] is most prevalent on the long, thin branches commonly developed by unpruned sour cherry trees [*R.A.M.*, xii, p. 640]. The overloading of the branches with fruit and consequent friction is a common source of channels of infection, which may be eliminated by the removal of superfluous wood.

LINDEGG (GIOVANNA). **Un deperimento dei Ciliegi.** [A wilt of Cherry trees.]—*Riv. Pat. Veg.*, xxiii, 9–10, pp. 347–356, 5 figs., 1933.

This is a preliminary report of the author's histological investigation of a wilt of cherries observed by her in 1933 in the vicinity of Bologna, the symptoms of which agree fully with those of the wilt of plums recently described by Goidanich from various parts of Italy [*R.A.M.*, xii, p. 769], with the exception that the rusty-red lesions on the trunk and branches were marked by heavy exudations of gum, under which the bark was in a rotting condition. While the cause of the disease has not yet been established, the presence was noticed in some of the wood vessels of numerous rod-shaped bodies which were readily stainable and are thought to be probably bacteria.

DODGE (B. O.). **The orange-rust of Hawthorn and Quince invades the trunk of Red Cedar.**—*Journ. New York Bot. Gard.*, xxxiv, 407, pp. 233–237, 2 figs., 1933.

In the course of a survey of red cedar [*Juniperus virginiana*] diseases near Mt. Kisco, New York, in the spring of 1933, several small trees were found to bear a hundred or more separate infections of two or three years' standing by *Gymnosporangium germinale* [*R.A.M.*, xii, p. 704] in addition to many recent ones. Many twigs apparently die off soon after the attack takes place, but if they survive for two to three years they may live for a long time in spite of the fungus, so that the ultimate injury to the cedar tree is slight. The mycelium spreads very slowly and its destructive action is mainly confined to the outermost living cells of the bark. Phytopathologists seem generally to have overlooked the occurrence of long-standing swellings or cankers due to this fungus on the large limbs and main trunk, showing up well after rain as rough blackish rings or patches up to 8 in. in diameter or 1 to 2 ft. long. Some infections on fifty-year-old trees observed by the writer must have occurred on the tip of the main axis at a very early stage in the growth of the host. One of the cankers examined may have been due to the combined action of *G. germinale* and *G. nidus-avis* [ibid., x, p. 634], the former alone not being usually responsible for so much additional wood tissue.

On hawthorns [*Crataegus* spp.] the rust pustules break out all over yellowish swellings on the leaves, fruits, and twigs during the summer.

Preti (G.). **Sulla ticchiolatura dei frutti del Sorbo domestico '*Sorbus domestica*'.** [Note on the scab of the fruits of the Service tree '*Sorbus domestica*'.]—*Riv. Pat. Veg.*, xxiii, 9–10, pp. 371–377, 4 figs., 1933.

A brief account is given of a disease observed during 1933, in the shape of scab lesions on the fruit, leaves, and less frequently on the twigs of the cultivated service tree (*Sorbus domestica*) [*Pyrus sorbus*] in Vallebona, Italy. The causal fungus, the perithecial stage of which was not found, is characterized by brownish-yellow, continuous conidia, rounded at the base and tapering at the apex, 20·3 by 11·6 μ in diameter, borne at the tips of short, erect, brown, unbranched, unicellular conidiophores, measuring 29 to 35 by 8·7 μ; it agrees closely with the description of *Fusicladium dendriticum* var. *sorbinum* Saccardo, with which it was identified.

Harris (R. V.). **Mosaic disease of the Raspberry in Great Britain. I. Symptoms and varietal susceptibility.**—*Journ. Pomol. and Hort. Science*, xi, 3, pp. 237–255, 3 pl., 1934.

This is a progress report of an investigation, started in 1921 at the East Malling Research Station, of the symptomatology of raspberry mosaic in England, some details of which have already been noticed from previous communications [*R.A.M.*, viii, p. 184; xii, p. 771]. The only symptoms by which mosaic can be distinguished from other diseases of raspberry are a yellowish mottling or speckling of some of the leaves of affected stools, associated with different degrees of leaf curling, twisting, or distortion, most usually seen on first-year canes. These symptoms are not visible on the first leaves unfolded in the spring; they have been observed as early as the end of April, but in most seasons they become apparent on the fruiting canes in the middle of May and not until early June on the canes of the current year's growth. The mottling does not appear on all the leaves of an affected stool, and in some varieties, e.g., Baumforth Seedling B, a zonation of intermittent development of the symptoms has frequently been observed, though almost invariably in such cases the last leaves to unfold in the season are mottled.

The range of leaf symptoms which has been observed in an extensive collection of raspberry varieties at East Malling is classified under three main symptom types; (*a*) mottling distributed evenly over the entire leaf surface, chlorotic patches not appreciably sunken and not associated with any curling or distortion of the laminae; (*b*) chlorotic patches ill-defined, tending to aggregate towards the leaf margins and between the main veins, slightly sunken and accompanied by a symmetrical down-curling of the laminae about the midrib, the symptoms varying in intensity on individual leaflets of a single leaf and being masked by high summer temperature conditions; (*c*) chlorotic spots sharply defined, deeply sunken or embossed, scattered, and associated with an asymmetrical twisting or crumpling of the laminae, these symptoms not being masked by high summer temperatures. More than one of these three types may occur on the same variety, sometimes even on the leaves of a single stool. In some varieties, e.g., Lloyd

George, Pyne's Royal, and Superlative, a classification cannot be made from observation alone, but must depend ultimately on some method of analysis such as grafting; an investigation started on these lines in 1928 gave some evidence that the types of mosaic described above may be related to two distinct forms of mosaic, a discussion of which is reserved for the future.

From field observations over a ten year period at East Malling, the author submits a tentative classification of raspberry varieties according to their relative apparent susceptibility (i.e., rate of degeneration after infection) and their apparent infectibility (Rankin's term 'klendusity', i.e., rate of spread of initial infection). In dealing with the problem of commercial control of the disease by roguing [loc. cit.], the necessity is stressed of a careful study of all the symptoms exhibited by a given variety at different times and under varying seasonal and weather conditions, since, besides the masking caused by high temperatures, the symptoms are also temporarily masked if the leaves are wet or are observed in direct sunlight.

The paper is prefaced by a brief review of the literature dealing with raspberry mosaic in America [ibid., xii, p. 770], from which it appears that the two main types (yellow mosaic and red raspberry mosaic) known there exhibit certain distinguishing characters in common with the two principal symptom types occurring on the red raspberry in England. A final comparison can only be made by cross-inoculation experiments by grafting methods under uniform conditions.

Smith (C. O.). **Some inoculations with Dothiorella ribis.**—Abs. in *Phytopath.*, xxiii, 11, p. 929, 1933.

The following are some of the 25 woody plants successfully inoculated through stem wounds with strains of *Dothiorella* [*Botryosphaeria*] *ribis* [*R.A.M.*, xii, p. 283] from walnut (*Juglans regia*) and avocado (*Persea americana*) [*P. gratissima*]: orange, lemon, grapefruit, four varieties of walnut, *Carya pecan*, loquat, Mammoth blackberry, plum, cherry (*Prunus avium*), *Diospyros kaki*, avocado, olive, *Psidium guajava*, willow (*Salix* sp.), elm (*Ulmus campestris*), and oak (*Quercus lobata*).

Wilcox (R. B.) & Beckwith (C. S.). **A factor in the varietal resistance of Cranberries to the false-blossom disease.**—*Journ. Agric. Res.*, xlvii, 8, pp. 583–590, 1 fig., 1933.

A brief account is given of tests [by a method which is described], the results of which are considered to indicate that the degree of susceptibility exhibited by certain varieties of cranberry to false blossom [*R.A.M.*, xiii, p. 41] is directly correlated with their degree of attractiveness to the leafhopper [*Euscelis striatulus*] vector of the disease. This attractiveness appears also to be similarly correlated with the relative rate of spread of false blossom under field conditions observed during several years in the five differential varieties used in the tests. The apparent resistance of some varieties to the disease seems to consist, at least in part, of their resistance to the insect vector.

WARDLAW (C. W.) & MCGUIRE (L. P.). **Cultivation and diseases of the Banana in Brazil.**—*Trop. Agriculture*, x, 7, pp. 192–197; 8, pp. 211–217; 9, pp. 255–259, 6 pl., 1933.

In this account of their observations of the diseases of bananas in the State of São Paulo, Brazil, the authors describe a bacterial wilt which in recent years has affected the Cavendish and Giant Fig varieties in the vicinity of Santos. On Cavendish the first symptom was a yellowing of the leaves, beginning with the lower ones, which later assumed a marked dingy or whitish-yellow tint, and became dry, flaccid, and drooping, and ultimately the plants rotted and collapsed. Young suckers from diseased plants showed browning and shrivelling of the leaf blades. Generally, the plants were not attacked until they were well grown, but once the leaf symptoms appeared little or no further development of the bunch took place. On Giant Fig the symptoms were similar, except that the leaf discoloration was lighter and the leaf margins not uncommonly turned brown; on this variety the disease appeared only at a late stage of growth, and well-grown daughter plants were quite healthy.

Yellow vascular discoloration was present in only a few of the outermost leaf sheaths, when infection had reached an advanced stage. In many plants showing five or six yellowish leaves the rhizome tissue appeared to be healthy, except for a pale yellow discoloration near the periphery of the stele; only when defoliation was almost complete was any conspicuous yellowing present at the periphery of the vascular ring. In the apex of plants so affected the vascular strands were pale blue and watery, softer dark areas indicating the formation of bacterial cavities in the parenchymatous tissues.

From its size, shape, cultural characters, and its ability to live in the vascular tissues of Solanaceous plants the organism consistently isolated from the affected vascular strands is provisionally referred to *Bacterium solanacearum*. It was successfully inoculated into tomato plants causing them to wilt, and re-isolated from the tissues at a distance from the seat of inoculation.

The disease occurred in isolated stools surrounded by healthy ones, spread to one, or at most two neighbouring stools, occurring during the year; in some instances considerable areas were attacked simultaneously, the plants being killed out in no definite succession in a few months. Its tendency to spread on humus-laden soils near the mangrove mud flats is regarded as serious, as some of these areas are highly productive. Directions are given for controlling the wilt by killing the roots of affected plants *in situ* with heavy gas oil [*R.A.M.*, xiii, p. 111] and by liming and aerating the soil.

In one plantation a characteristic leaf mottling of the suckers was observed, light, chlorotic broken stripes extending from the midrib to the leaf margin and later becoming yellowish- or brownish-red. The symptoms became progressively intensified on the younger leaves. Some leaves bore the mottling over their entire surface, while on others infection appeared in localized bands. The distribution of healthy and affected plants suggested that the disease was infectious and was transmitted by an insect with a

short flight range. Similar leaf markings were later found in widely separated localities on Cavendish and Giant Fig. It is considered that the disease, which in some respects resembled that reported by Magee from New South Wales [ibid., x, p. 472], is probably an infectious chlorosis due to a virus. The aphid *Pentalonia nigronervosa*, which transmits banana virus diseases [ibid., xi, p. 157; xiii, p. 111], was much in evidence.

On several plantations a brown bulb rot of Cavendish and Giant Fig appeared to have been present for some years. Though fatal to the individual plant it did not spread rapidly from stool to stool. It was usually found on areas recently reclaimed from virgin forest, and involved either individual stools or patches of twenty or more. On the Cavendish variety the plant as a whole looked unhealthy; the leaves were yellow, without marginal discoloration or withering, but deep yellow bands sometimes extended from the midrib to the margin. The older leaves withered very slowly, turned brown and broke down at the point of junction with the trunk, the younger leaves showing numerous secondary leaf spots; plants with advanced infection still carried a fair crown. On the Giant Fig variety the leaves in general were discoloured, but a marginal yellowing followed by browning was characteristically present and the disease progressed more rapidly than on Cavendish. With both varieties advanced infection was marked by complete rotting of the bulb, and the plants could easily be pushed over. Infection began at the base of a sucker or bulb and progressed upwards towards the apex. At the upper extremity of the infection the sucker tissue showed pale orange, yellow or brownish, water-soaked areas bounded at the edge of the healthy tissue by a dark red, undulating line, forming finger-like projections. In the older infected parts the tissue became brownish, while lower down, in the still more severely affected parts the tissue was pale amber and of a waxy consistency. The affected bulbs smelt strongly of mushrooms. It is provisionally suggested that the rot (which is not a source of serious loss) is due to a fungus belonging to the Agaricaceae or Polyporaceae.

A few unimportant infections by *Marasmius semiustus* [*M. stenophyllus*: ibid., vii, p. 703; xi, p. 97] were noted.

Most of the leaf spot observed (of which very little was present) was due to *Scolecotrichum musae* [considered by v. Höhnel to be a *Cordana*: ibid., iii, p. 103; xii, p. 458].

PARK (M.). **Panama disease of Plantains.**—*Trop. Agriculturist*, lxxxi, 5, pp. 330–333, 1933.

Panama disease of plantains (*Fusarium oxysporum cubense*) was first identified in Ceylon in 1930 [*R.A.M.*, x, p. 472; xii, p. 77] and has since been observed in a number of widely separated localities in the island, its distribution indicating that it is not new to Ceylon, where it is well established but seldom assumes serious proportions.

Inoculation experiments demonstrated that the incubation period is usually eight, but may extend to thirteen, months, and during this period suckers from infected stools may carry the disease, one

severe outbreak near Colombo [ibid., xiii, p. 78] being probably due to this source of infection.

In Ceylon the disease is severe only in localities where plantains are grown under adverse conditions of soil or cultivation; in some areas outbreaks are commonest after floods.

Brief notes are given on prevention and control by the use of healthy planting material and the destruction of the roots of diseased plants by means of a toxic oil [ibid., xiii, p. 111].

Wardlaw (C. W.) & McGuire (L. P.). **Banana storage. An account of recent investigations into the storage behaviour of several varieties.**—*Empire Marketing Board Publ.* 72, 40 pp., 4 pl., 1933.

In this report of storage trials of various types of bananas at the Low Temperature Station, Trinidad, it is stated that a new hybrid I.C. 2 [cf. *R.A.M.*, xi, p. 383] has been ascertained to be highly resistant to or actually immune from Panama disease [*Fusarium oxysporum cubense*]. Like Gros Michel it resists bruising and ripens to an attractive colour. The flesh is also of good texture and superior flavour to I.C. 1. The bunches obtained (on relatively poor soil) were small, and the fingers short, thick, and closely packed.

For the first time during these storage trials in Trinidad pitting disease [*Piricularia grisea*: ibid., xi, p. 728] was present, the varieties affected being Giant Governor and Governor [both varieties of *Musa cavendishii*]; Gros Michel showed a very mild, economically unimportant infection.

Condit (I. J.) & Horne (W. T.). **A mosaic of the Fig in California.**—*Phytopath.*, xxiii, 11, pp. 887–896, 4 figs., 1933.

An expanded account is given of the writers' study on fig mosaic in California, a brief notice of which has already appeared [*R.A.M.*, xii, p. 382]. The leaves show light yellow spots, sometimes sharply delineated, but more usually shading into the dark green of the healthy parts. In the former case there may be a rust-coloured necrotic band around the spot, but general necrosis of the latter was not observed. On the fruit the symptoms are similar. Of the five leading commercial varieties, Kadota and Calimyrna are little affected, White Adriatic and Brown Turkey are sufficiently resistant under good cultural conditions, while Mission suffers severely. In an experimental planting of over 100 varieties at Riverside, only one has shown virtual immunity—an entire-leaf capritig form of *Ficus palmata*, but a high degree of resistance has been shown by Biskra, Hamma, Pastiliere, and a lobed-leaf form of *F. palmata*. Among the more susceptible varieties may be mentioned Ischia, Celeste, Cheker Injir, Baalie, Panache, Roeding No. 3, De Jerusalem, and Sultane.

Baker (R. E. D.). **Papaw root and collar-rot.**—*Trop. Agriculture*, x, 11, pp. 328–329, 1933.

The results of inoculations with single spore cultures from isolations made by G. C. Stevenson of a *Fusarium* and a *Pythium* from

collar rot of *Carica papaya* in Trinidad [cf. *R.A.M.*, xi, p. 330] showed that in a stem wound the former fungus killed 11 out of 24, and the latter 8 out of 24 plants inoculated; when inoculated into the roots the *Fusarium* killed none and the *Pythium* 1 out of the 12 plants tested with each fungus.

It is concluded that both organisms, when favoured by exceptional humidity at the base of the trees, are capable of killing *C. papaya*. In a normally dry season special control measures are superfluous, but during an unusually wet spell the base of the trees should be bared and drainage attended to.

SWARBRICK (T.). **Spraying technique.**—*The Fruit-Grower*, lxxvi, 1978, pp. 813–815, 1933.

An account is given of the leading principles underlying the fruit tree spraying technique that has been evolved at the Long Ashton Research Station, Bristol, since 1927 [*R.A.M.*, xiii, p. 103]. The subject is discussed under the headings of quantity and time factors, labour problems, spraying machines, adjustable and fixed nozzles, coarse v. fine mist sprays, quantity of wash, high working pressures, and form of spray outfit. Much importance is attached to the use of high working pressures (350 to 400 lb.), spray guns with replaceable disks, a 'penetrating' spray, and a 'mobile' as opposed to a stationary system of application. In the writer's opinion, no hope of successful economical and consistent pest and disease control can be entertained unless the complete spraying programme can be carried out in five working days.

LINK (G. K. K.). **Etiological phytopathology.**—*Phytopath.*, xxiii, 11, pp. 843–862, 1933.

A general survey is given of the etiological aspect of phytopathology, which is treated in the broadest sense to include all the consequential antecedents of plant diseases. These are classified under the headings of internal or constitutional pathogenic factors, past history and correlative influences, external pathogenic factors, and external agents, living and non-living. A thoroughgoing etiological pathology considers all possible antecedents of the diseased condition and not merely, as is too often the case, the single immediate cause (such as the attack of a parasite) which incites the disease.

GRAINGER (J.). **Virus diseases of plants.**—104 pp., 6 pl., 6 figs., 2 graphs, Oxford University Press, 1933.

This book is intended as a simple text-book for the student of mycology or plant pathology, and contains mainly an account of the phenomena associated with virus diseases, rather than descriptions of a large number of these diseases. The subject-matter is arranged under chapter headings which include the following: the relations of a virus to its host, properties of the virus extract, the relations of insects to virus diseases, economic effects and control, and the classification and description of virus diseases. There is a bibliography of 445 titles.

Sassuschin (D.). **Zum Studium der Parasiten vom Typus Protozoa bei Pflanzen des Südostens RSFSR.** [Contribution to the study of parasites of the protozoal type in plants of the south-east of the U.S.S.R.]—*Zool. Anzeiger*, ciii, 11–12, pp. 304–306, 1 fig., 1933.

Flagellates measuring 10 to 23 by 1·5 μ (flagellum 7 to 10 μ) were detected in the latex of 6 per cent. of the *Euphorbia uralense* plants investigated by the writer in the Saratov district of south-eastern Russia in 1929 and 1930. A more comprehensive examination in the latter year of 587 bushes revealed the flagellate (identified as *Phytomonas* [*Leptomonas*] *davidi*) [*R.A.M.*, vi, p. 437] in 10·7 per cent. The parasites were commonly located near the flower buds; owing to their extreme motility their structure was difficult to determine, but the characteristic spiral form was observed in a number of cases. In fixed preparations stained by the Romanowsky-Giemsa technique the organism could be studied in various stages of development and division. The nucleus is situated near the front of the body. The infected plants were yellow and wilted and inoculation experiments with the flagellate on healthy bushes induced the typical symptoms in 4 to 15 days.

Horn (K.). **Mykorrhizasopp som hekseringdanner.** [Mycorrhiza fungus as a producer of fairy rings.]—*Friesia Nord. Mykol. Tidsskr.*, i, 2, pp. 81–83, 2 figs., 1933. [English summary.]

In 1932 *Hebeloma crustuliniforme* was observed forming fairy rings in the grass (mostly consisting of *Alopecurus pratensis*, *Dactylis glomerata*, and *Poa pratensis*) round young birches (*Betula lenta*) in the Oslo (Norway) Botanic Garden. On examining the root systems of the trees the fungus was found in mycorrhizal association with them, occupying the outer tissues of the absorbing roots, the aspect of which agreed with Melin's description of birch mycorrhiza [*R.A.M.*, iii, p. 358]. *H. crustuliniforme* is stated to be prevalent in east and west Norway wherever birches are grown.

Brown (R.). **Nitrogen fixation by the endophyte of Lolium.**—*Journ. Agric. Sci.*, xxii, 4, pp. 527–540, 2 figs., 1933.

After a review of the literature relative to the endophytic fungus of *Lolium* [*R.A.M.*, v, p. 379 *et passim*] and to the problem of its capacity of fixing or assimilating free atmospheric nitrogen [ibid., xii, p. 779], the author describes in detail experiments in which he grew *Lolium perenne* from surface sterilized commercial seed under strictly controlled conditions on synthetic media with and without the addition of nitrate, and also in an atmosphere in which nitrogen was replaced by oxygen. At the end of eight weeks the results showed that the poorest growth was made by the plants without nitrate in the culture medium, as indicated by the fact that they had a leaf length of only 21·5 cm. and a dry weight of 0·00148 mg., as compared with 26·4 cm. and 0·0018 mg., respectively, in the nitrate medium. Absence of nitrogen from the atmosphere had a still further depressing effect on the seedlings in the former solution, as their leaf length was reduced to 18 cm.

and their dry weight to 0·00136 mg. The author's data are considered to indicate that *L. perenne* does meet some, but only a part, of its nitrogen requirements from atmospheric sources, especially when nitrogen in the combined form is absent from the nutrient medium. The presence of a considerable quantity of urea in the *Lolium* roots infected by the endophyte, as well as certain morphological details of the latter, would indicate a continuous transference of nitrogenous material from the endophyte to the host during the period of growth.

FREISLEBEN (R.). **Über experimentelle Mykorrhiza-Bildung bei Ericaceen. (Vorläufige Mitteilung.)** [On experimental mycorrhiza formation in Ericaceae. (Preliminary note.)]—*Ber. Deutsch. Bot. Gesellsch.*, li, 8, pp. 351–356, 1 pl., 1933.

From the roots of *Vaccinium myrtillus* in Saxony the writer isolated an endophytic fungus in hanging drops of malt agar. In order to determine the effect of the endophyte on the plants, bilberry seeds were divided into four groups, of which (1) was extracted aseptically from the berries but not disinfected, and grown in Erlenmeyer flasks on a mixture of peat mould and sand inoculated with the fungus; (2) was similarly treated but without inoculation; (3) was surface-disinfected with 0·1 per cent. mercuric chloride and the substratum inoculated; and (4) as (3) but without inoculation. For the first three or four weeks all the plants made about equal growth, but thenceforth differences became noticeable, the inoculated groups (1) and (3) developing vigorously and completely filling the flasks after three to five months, whereas the uninoculated controls made practically no growth. The root system of the former groups was profusely branched and almost white, in marked contrast to the dark brown stumps, only 1 to 3 mm. long, of the latter. Microscopic examination showed that the lateral roots of the inoculated plants were completely transformed into endotrophic mycorrhiza fully equalling those observed in nature. In opposition to M. C. Rayner's results [*R.A.M.*, viii, p. 455], no trace of mycelium could be detected in the tissues of the shoots of the plants, even those of the uninoculated group of seedlings from not disinfected seed [cf. ibid., xi, p. 317].

No definite statement can be made at the present stage of the investigations with regard to the distribution of endophytes in the shoots and berries of the Ericaceae, but it seems evident that their presence in the aerial portions of Ericaceous plants is less general than M. C. Rayner assumes. It is also not yet possible to assign the root fungus to its correct systematic position owing to the absence of fructifications, and the provisional name of *Mycelium radicis myrtilli* is therefore proposed. A full description of the fungus is reserved for later publication, but meanwhile attention is briefly drawn to the penetration of the infected cortical root cells in culture by hyphae, some 50 per cent. of which are enveloped in cuff-shaped thickenings formed by the host cells and evidently of similar origin to the 'boxes' observed by Burgeff (Saprophytismus und Symbiose, Jena, 1932) in the Orchidaceae. No such structures have hitherto been described in connexion with the mycorrhiza of the Ericaceae, although they also occur in a

somewhat less conspicuous form in nature, and were further detected in *V. vitis-idaea* and *V. uliginosum*.

DICKSON (H.). **Saltation induced by X-rays in seven species of Chaetomium.**—*Ann. of Botany*, xlvii, 188, pp. 735–754, 2 col. pl., 24 figs., 3 graphs, 1933.

The experiments described in detail in this paper were made to ascertain whether the ready response by saltation exhibited by *Chaetomium cochlioides* when exposed to the action of X-rays reported in a previous communication [*R.A.M.*, xi, p. 593] was shown by other species of the genus, of which six [named] were tested. Saltation was induced by the treatment in all the seven species; comparatively infrequently in four, while the other three saltated very readily. Control cultures of the fungi indicated that the parent strains of five of the species are quite stable when not subjected to irradiation, but saltants were very occasionally produced by the un-irradiated cultures of *C. fieberi* var. *rufipilum* and *C. murorum*. The variant characteristics of the various species are described, with figures of the saltant perithecia, and notes are also given on the effect on growth form and rate of growth of the saltants and their parent strains, of variations in the culture medium, the reactions showing some points of similarity with those obtained by Brown in his work with species of *Fusarium* [ibid., iv, p. 627].

SMITH (H. R.) & CAMERON (E. J.). **Mold growth test for minute amounts of arsenic.**—*Indus. & Engin. Chem.*, Analyt. Ed., v, 6, pp. 400-401, 1933.

Full details are given of a method, based on the liberation of arsenic in gas form by *Scopulariopsis brevicaulis* (*Penicillium brevicaule*) [*R.A.M.*, xii, p. 714], for the detection of minute quantities (down to 1 p.p.m.) of arsenic in food samples.

SATOH (S.). **Studien über die Wirkungen der durch Ophiobolus miyabeanus gebrauchten Nährlösungen auf die Keimung und Entwicklung eines anderen Pilzes.** [Studies on the effects of nutrient solutions utilized by *Ophiobolus miyabeanus* on the germination and development of another fungus.]—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], i, pp. 71–83, 2 graphs, 1931. [Japanese with German summary. Received February, 1934.]

Two kinds of substances are stated to be formed in the culture liquid of *Ophiobolus miyabeanus* [an important parasite of rice in Japan: *R.A.M.*, xii, p. 532], one of which accelerates and the other retards the germination and growth of *Aspergillus niger*. The former traverses a Chamberland filter (F) but not the latter. The inhibitory effect is more readily counteracted by dilution of the solution than the growth-promoting influence. The chemical composition of the substances was not determined, but that with an accelerative action was found to be thermostable while the substance retarding development in *A. niger* speedily succumbed to heat. Both substances appear to produce their maximum effects on *A. niger* during its first week of growth.

Morwood (R. B.). **Potato diseases.**—*Queensland Agric. Journ.*, xl, 5, pp. 382–395, 4 pl., 1933.

Brief, popular notes are given on the symptoms, causes, and control of the following potato diseases occurring in Queensland: blight (*Phytophthora infestans*), target spot (*Alternaria solani*), wilt (*Fusarium oxysporum*), dry rot (*F.* spp.), bacterial wilt (*Bacterium solanacearum*), blackleg [*Bacillus phytophthorus*], scab [*Actinomyces scabies*], black scurf (*Corticium solani*), the minor root and stem rots due, respectively, to *Armillaria mellea* and *Sclerotium rolfsii*, and common virus and physiological diseases, as well as on powdery scab (*Spongospora subterranea*) and wart disease (*Synchytrium endobioticum*), neither of which has been recorded in the State. The paper concludes with recommendations for securing a healthy crop, and instructions for making and using hot formalin solution and Bordeaux and Burgundy mixtures.

Folsom (D.). **Potato virus diseases in 1932.**—*Amer. Potato Journ.*, x, 11, pp. 224–233, 1933.

Recent American and European literature (1931–2) on potato virus diseases is briefly reviewed on the lines of previous surveys [*R.A.M.*, xii, p. 187]. Many of the papers referred to have been noticed from time to time in this *Review*.

McKay (M. B.), Dykstra (T. P.), Morris (H. E.), Young (P. A.), Richards (B. L.), & Blood (H. L.). **Virus and viruslike diseases of the Potato in the Northwest and their control.**—*U.S. Dept. of Agric. Circ.* 271, 32 pp., 8 pl., 19 figs., 2 plans, 1933.

In this paper the authors give a full account in popular terms of the more important results of practical value obtained after several years' study of the virus and virus-like diseases of potatoes in the north-western parts of the United States. The material is arranged under such headings as general characteristics of potato virus diseases, types of such diseases (including mild, crinkle, rugose, leaf-rolling and other forms of mosaic, calico, leaf roll, witches' broom, psyllid yellows, spindle tuber, and giant hill), agents of spread, and control by the isolated seed-plot method.

Clinch (Phyllis) & Loughnane (J. B.). **A study of the crinkle disease of Potatoes and of its constituent or associated viruses.**—*Scient. Proc. Roy. Dublin Soc.*, xx (N.S.), 37–40, pp. 567–596, 2 pl., 1933.

This is a full account of the authors' studies [a preliminary report of which has already been noticed: *R.A.M.*, xii, p. 717] of the potato virus diseases belonging to the mosaic group, namely: simple mosaic, the crinkle complex, identical with Salaman's crinkle A [ibid., xi, p. 739] and its constituents virus A [ibid., xi, p. 740] and either simple or interveinal mosaic, and Up-to-Date streak, which combined with virus A also produces a type of crinkle. The characteristics of these diseases are briefly described. Experiments showed that simple mosaic is inoculable by needle (but is not transmissible by *Myzus persicae*) to tobacco, *Datura*

stramonium, and certain other Solanaceous hosts, and also to other potato varieties, including Arran Crest, in which it causes top necrosis. Crinkle A was transmitted in full from potato to potato by grafting, but needle inoculations only transmitted one of the constituents of the complex, namely, a simple mosaic which is termed mosaic *ex* C; when crinkle A was inoculated by needle into tobacco, *Datura stramonium*, *Nicandra physaloides*, or *Petunia* sp., and returned thence to President potato, a simple mosaic was obtained, which is considered to be identical with mosaic *ex* C. The latter corresponded to simple mosaic in its general reactions, the differences between the two observed so far being in degree rather than in kind.

The second constituent of crinkle was transmitted by grafting (but not by needle) and by *M. persicae* from potato to potato, and caused a transient veinal mottle in President and top necrosis in British Queen and Up-to-Date, all the evidence pointing to its identity with the A virus which occurs naturally in an almost latent condition in Irish Chieftain potato. It was shown to be transmissible by the aphid and by needle to tobacco, in which is caused green vein-banding, but could not be returned by needle from tobacco to potato; it was transmitted to *D. stramonium* by grafting, but all attempts to inoculate it by needle into this host or a number of other solanaceous plants failed. A crinkle, identical in its symptoms with that occurring in nature, was reproduced when virus A was combined with mosaic *ex* C in healthy President potato plants. Interveinal mosaic was shown to agree in most of its reactions with mosaic *ex* C, and also reproduced crinkle when combined with virus A in President, identical in its foliage symptoms with the natural disease but with the addition of lesions characteristic of interveinal mosaic in President.

The latent acronecrotic streak virus of Up-to-Date was shown to be filterable and inoculable by needle to tobacco and *D. stramonium*, and to be transmissible from the latter to potato by grafting, but not by the needle. It was, however, transmitted by needle from Up-to-Date to Arran Crest potatoes, in which it produced top necrosis. The experiments suggested the presence in the stock of Up-to-Date used of only one virus entity, that of acronecrotic streak.

The results of this investigation [which are very fully discussed] lead the authors to believe that crinkle A is a mixture, rather than a compound, of two viruses, each of which belongs to a distinct type. The A virus is of a similar type to Smith's Y virus [ibid., xi, p. 394], though definitely distinct from the latter, while the *ex* C virus corresponds to Smith's X type. They also suggested that all the viruses dealt with are separable into two natural groups, of which the X and Y viruses may be considered to be the types.

Tucker (J.) & Harber (E. W.). **Seed treatment for Potato blackleg.**—*Scient. Agric.*, xiv, 2, pp. 70–72, 1933. [French summary on p. 107.]

Official reports [a general summary of which is given in two tables] received from 1928 to 1932, inclusive, from all the repre-

sentative potato-growing areas of Canada, showed that during the period under review blackleg [*Bacillus phytophthorus*: *R.A.M.*, xii, p. 719] caused an average loss of crop of 0·34 per cent. in 23,959 fields sown with certified untreated seed, while in 13,218 and 6,846 fields sown with seed treated with mercuric chloride and formalin, respectively, the loss was 0·18 and 0·31 per cent. These results would indicate that the cost of treating the certified seed is not warranted from a purely economic standpoint, except in localities where conditions are particularly favourable for the development of the disease.

KIESSLING (L. E.). **Wachstumsverlauf von Actinomycetenstämmen und seine quantitative Bestimmung auf verschiedenen Kartoffelnährsubstrat.** [The growth process of strains of Actinomycetes and its quantitative determination on different kinds of Potato medium.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxix, 8-12, pp. 177–196, 1 graph, 1933.

A detailed and fully tabulated account is given of the writer's experiments to determine the influence of the potato variety used in the composition of the medium on the growth of various species and strains of Actinomycetes, including pure cultures of *Actinomyces scabies*, *A. flavus* [*R.A.M.*, xii, p. 783; xiii, p. 50], *A. chromogenes* [ibid., x, p. 381], *A. setonii*, and *Nocardia odorifera* from the Centraalbureau voor Schimmelcultures, Baarn, Holland, and two strains (A and B) of *Actinomyces* isolated from compost. The fungi grew well on a substratum consisting of one part of the expressed juice of potato tubers or stems to two of an appropriate synthetic solution.

Electrometrical determinations of the changes induced by the Actinomycetes in the reaction of the medium showed that, with the exception of *A. flavus* and *N. odorifera*, all the strains caused a marked increase of alkalinity. Well-marked differences were apparent in the quantity of the mycelium formed during growth on the expressed juices of 14 standard potato varieties, the smallest amounts being produced on the juice of the early ripening sorts. It is evident from the author's results that the Actinomycetes are sensitive to differences in the composition of the expressed juices conditioned by varietal characters, stage of maturity, and origin.

MÜLLER (K. O.). **Über die Biotypen von Phytophthora infestans und ihre geographische Verbreitung in Deutschland. (Vorläufige Mitteilung.)** [On the biotypes of *Phytophthora infestans* and their geographical distribution in Germany. (Preliminary note).]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 11, pp. 91–92, 1 map, 1933.

The writer's laboratory experiments with isolations of *Phytophthora infestans* collected from widely separated localities of Germany during 1932 have confirmed the occurrence of biologic specialization within the species [*R.A.M.*, xiii, p. 179] which may be divided into three main groups, viz. (1) the ubiquitous A type capable of attacking the standard commercial varieties but not the 'W' strains; (2) the S type, parasitic both on standard varieties and

'W' strains but not on *Solanum demissum* and its hybrids with *S. tuberosum*; (3) transitional types infecting the tubers of the 'W' strains more severely than type A but not attacking their foliage in the greenhouse after a week's incubation. It is noteworthy that the S biotype of *P. infestans* is restricted to those localities of north Germany and Bavaria in which potato seed selection establishments are situated, affording ample opportunity for unchecked propagation on the 'W' strains. The transitional type has been found mainly in East Prussia, the Thuringian Forest, and the Eifel. Undue importance should not be attached to the unexpected susceptibility of the 'W' strains to the new biotype of *P. infestans*, since resistance to the widespread A type is the main practical consideration. Some years must certainly elapse before the S type gains a firm footing in the country, and in the meantime its extension must be combated by the development of the *S. demissum* hybrids.

NAPPER (MAUDE E.). **Observations on Potato blight (Phytophthora infestans) in relation to weather conditions.**—*Journ. Pomol. and Hort. Science*, xi, 3, pp. 177–184, 1933.

The results of the experiments briefly reported in this paper showed that conidia of *Phytophthora infestans* produced on potato leaves with a very high water content kept in a saturated atmosphere will not germinate immediately after removal from the saturated chamber but will do so if gathered after the water content of the host tissues has been reduced by about 4 to 18 per cent. of the maximum by exposure to dry air. As in the experiments with *Cystopus candidus* [*R.A.M.*, xiii, p. 70] it was assumed that in the desiccation process the conidia of *P. infestans* lost an amount of water approximately equal to the reduction in the water content of the host tissues, as indicated by the fact that conidia attached to the host do not dry out until the host cells are dry. In further experiments it was shown that the rate of mycelial growth of the fungus in inoculated leaves and the production of conidia vary directly with the water content of the host tissues both in resistant (e.g., President) and in susceptible (e.g., Up-to-Date) varieties. The general conclusions drawn from these results indicate that the successful establishment and development of the blight depend chiefly upon weather conditions, a period of heavy rainfall, high relative humidity, little wind, and a moderate temperature being the main predisposing factors. The attack is intensified if this period is broken by a short spell of dry weather followed closely by wind and rain or heavy dew, and may attain epidemic form if this sequence of events is repeated.

DU PLESSIS (S. J.). **Die morphologiese eienskappe en die parasitisme van verskillende Fusaria op Aartappels.** [The morphological characters and parasitism of various species of *Fusarium* on Potatoes.]—*Ann. Univ. Stellenbosch*, xi, Ser. A, 3, 24 pp., 8 figs., 1933. [English summary.]

Wilt disease of potatoes in South Africa is stated to be mainly due to *Bacillus* [*Bacterium*] *solanacearum*, with which are sometimes associated species of *Fusarium*. The following have also

been isolated from potato tubers affected by dry, wet, or stem-end rots: *F. bulbigenum* var. *blasticola*, *F. orthoceras* and its var. *albido-violaceum*, *F. oxysporum* and its form 1 [*R.A.M.*, xiii, p. 128], *F. coeruleum*, *F. solani*, *F. sambucinum*, and *F. argillaceum* [ibid., xii, p. 317]. Full descriptions are given of the cultural and morphological characters of these species, of which the first five (all in the Elegans section) were found to be the most important potato tuber-rotting agents. On inoculation into Up-to-Date tubers *F. oxysporum* form 1 produced a dry rot and *F. bulbigenum* a semi-watery type of decay. Greenhouse inoculations with all the species on the wounded stems of healthy plants gave negative results.

Rosen (H. R.). **Influence of spray applications on air temperatures surrounding sprayed Potato plants.**—*Phytopath.*, xxiii, 11, pp. 912–916, 1 graph, 1933.

In a four-year study of the factors responsible for the injury caused by 4-4-50 Bordeaux mixture in southern Arkansas to potato plants sprayed against tipburn [*R.A.M.*, ix, p. 266] it was found that the application of the fungicide is generally accompanied by sudden and precipitous drops in the surrounding air temperature, ranging from 1·5° to 8° C. The effect of such abrupt temperature changes on the health of the plants has not been studied, but the present observations suggest that the midsummer spraying of plants in the warmer regions of the United States is attended by greater risks of injury than in the cooler districts.

Fukushi (T.). **Transmission of the virus through the eggs of an insect vector.**—*Proc. Imper. Acad. Sci.*, Tokyo, ix, 8, pp. 457–460, 1933.

In the course of studies on the transmission of the virus of rice dwarf in Japan [*R.A.M.*, xi, p. 324], the writer confined pairs of male and female leafhoppers (*Nephotettix apicalis* var. *cincticeps*), the insect vector of the disorder, on healthy young rice plants in glass tubes, each couple remaining on a plant for one day before transference to a new one. The females used were nymphs which were separately confined until they became adult so as to avoid risk of outside copulation, and in some of the experiments both they and the males were separately confined on diseased plants to render them infective. After pairing, the eggs were laid by the female in the leaf sheath and thrust transversely into the tissue, hatching out after about ten days. On emergence the nymphs were immediately transferred, before they had time to feed, to healthy plants and kept under observation for two months or longer. Successful transmission of rice dwarf in the ensuing numerous tests was obtained in nearly 100 per cent. of the cases when infective males were crossed with infective females, and the figures were almost equally high when the females only were infective, whereas entirely negative results followed the crossing of uninfective females with infective males. This is claimed to be the first case in which the transmission of a virus through the egg has been actually demonstrated.

SETO (F.). **Über das verschiedene Verhalten der Reiskeimlinge bei der 'Bakanae'-Krankheit.** [On the varying reaction of Rice seedlings to the 'bakanae' disease.]—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 20–29, 1933. [Japanese summary.]

In order to express the different kinds of relationship existing between rice seedlings and the causal organism of the 'bakanae' disease (*Gibberella fujikuroi*) [*R.A.M.*, xii, p. 719] in Japan, the writer makes use of Fischer's and Gäumann's conception of aggressiveness and virulence [ibid., ix, p. 19]. Arising out of the difference between the aggressiveness of the fungus and the host's capacity for resistance are three possibilities with respect to the virulence of the former. (1) The resistance of the host may be so far superior to the aggressiveness of the parasite that the latter is unable to penetrate the seedlings, which consequently remain healthy. (2) Aggressiveness on the one hand and resistance on the other may be equally balanced so that the parasite can be described as aggressive but not virulent. An example of this type of relationship is afforded by the recent detection of externally healthy rice seedlings from which *G. fujikuroi* is readily isolated on artificial media [ibid., xi, p. 537]. (3) The aggressiveness of the pathogen is greater than the host's capacity for resistance so that a condition of virulence results, leading to the establishment of the parasitic relation, which may assume one of two diametrically opposed forms, causing either acceleration or retardation of growth. Corresponding to these effects, two groups of virulence may be recognized, namely, 'plus' and 'minus', the former representing the accelerative action of the fungus on the rice seedlings, as commonly observed in nature, and the latter the strongly retarding influence [ibid., xi, p. 536].

Details are given of a series of tests with strains of *G. fujikuroi* isolated from plants showing no symptoms of disease and from those with the plus and minus types of virulence, which indicated that all three groups behaved in the same manner, producing sometimes overgrowth, sometimes dwarfing, and sometimes no symptoms, though one of the strains was predominantly dwarfing. External conditions, such as the temperature of the soil in which the plants were grown, were found to affect the symptoms produced by a given strain of the fungus.

SETO (F.). **Untersuchungen über die 'Bakanae'-Krankheit der Reispflanze. III. Über die Beziehungen zwischen der Bodenfeuchtigkeit und dem Krankheitsbefall durch Bodeninfektion.** [Investigations on the 'bakanae' disease of the Rice plant. III. On the relations between soil moisture and the incidence of disease through soil infection.]—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 125–137, 2 figs., 1933. [Japanese, with German summary.]

Previous observations and experiments by the writer and others have shown that the infection of rice seedlings by the 'bakanae' disease (*Gibberella fujikuroi*) [see preceding and next abstracts] through the soil is in general confined to plants on moist ground, those growing under dry conditions showing the exactly opposite

symptoms of stunting or foot rot. The 'plus' (accelerative) and 'minus' (retarding) activities of the fungus were clearly demonstrated both under experimental and field conditions, and were shown to be produced by the same fungus.

SETO (F.). **Untersuchungen über die 'Bakanae'-Krankheit der Reispflanze. IV. Über die Beziehungen zwischen der Bodentemperatur und dem Krankheitsbefall bei Bodeninfektion.** [Investigations on the 'bakanae' disease of the Rice plant. IV. On the relations between soil temperature and the incidence of disease through soil infection.]—*Forsch. auf. dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 138–153, 1933. [Japanese, with German summary.]

The results of controlled inoculation experiments on rice indicated that a soil temperature of 35° C. is the most suitable both for seedling growth and infection by *Gibberella fujikuroi* [see preceding abstracts]. 'Bakanae' seedlings developed to some extent at a soil temperature of 25° but at 20° the symptoms were generally absent. At 40° the growth of the seedlings was much retarded and the development of diseased ones suppressed. Although the maximum number of diseased seedlings developed in soil at 35°, the actual optimum for the growth of *G. fujikuroi* was found to be 25° [*R.A.M.*, xi, p. 399], at which soil temperature the symptoms were much less apparent. It was ascertained, however, that the fungus is present to the extent of practically 100 per cent. in the tissues of the externally healthy inoculated seedlings kept at a soil temperature of 25°. The effect on the disease would thus appear to be due rather to the action of the soil temperature on the seedlings than on the fungus.

IKEYA (J.). **On a disease of the Rice plant caused by Gibberella saubinetii (Mont.) Sacc.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 292–313, 1 pl., 1 fig., 1933. [Japanese, with English summary.]

Practically no morphological or physiological differences could be detected in the writer's comparative studies between strains of *Gibberella saubinetii* isolated from wheat and rice [*R.A.M.*, iii, p. 422; xi, p. 537], respectively. The optimum temperature for mycelial growth in both strains on apricot or potato decoction and soy-bean agars was found to be about 28° C. Inoculation experiments with the wheat strain gave positive results on rice. *G. saubinetii* caused more damage to rice seedlings on soils kept at 20° and 24° than at 28° and 32° C. Filtrates of culture solutions in which the fungus had grown were toxic to cut stems of watermelon, cucumber, and horse bean [*Vicia faba* var. *minor*].

IKENO (S.). **Studies on Sclerotium diseases of the Rice plant. VII. On the influence of continuous wetting and discontinuous wetting on infection of the Rice plant by Hypochnus sasakii Shirai.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 219–237, 1933. [Japanese, with English summary.]

Rice plants inoculated with *Hypochnus* [*Corticium*] *sasakii*

under conditions of discontinuous wetting contracted heavier infection and required a shorter minimum time of total wetting to effect it than those exposed to continuous wetting [*R.A.M.*, xiii, p. 124]. On exposure of the plants to alternating brief periods of drying and wetting, the incidence of infection increased in proportion to the duration of the former. The course of infection in inoculated plants exposed to direct sunlight out-of-doors during drying is somewhat irregular as compared with greenhouse results. If the sclerotium is inserted between the leaf sheath and culm of the plant near the ligule and a suitable temperature for the growth of the fungus is maintained, the normal atmospheric humidity of the greenhouse suffices to permit infection without any additional water supply. Infection occurs somewhat more readily on the lower than on the upper portion of the culm. The minimum incubation period of *C. sasakii* on rice in these tests was 24 hours and the normal between two and three days.

IKENO (S.). **Studies on Sclerotium diseases of the Rice plant. VIII. On the relation of temperature and period of continuous wetting to the infection of Soy-Bean by the sclerotia of Hypochnus sasakii Shirai and on autolysis of the same fungus.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 238–256, 1 fig., 1 graph, 1933. [Japanese, with English summary.]

The minimal periods of continuous wetting necessary for the infection of soy-bean by *Hypochnus* [*Corticium*] *sasakii* [see preceding abstract] under experimental conditions were found to be about 24 hours at 24° and 18 at 28° and 32° C. With injured leaves the minimal periods are 24 hours at 20° and 24°, 18 at 28°, and 12 at 32°. Negative results were given in these tests by inoculation experiments at 34° and 36°. The optimum temperature for soy-bean infection by *C. sasakii* (28° to 32°) is thus the same as for rice. Autolysis was clearly evident in cultures of *C. sasakii* on Richards's solution.

ABE (T.). **On the influence of soil temperature upon the development of the blast disease of Rice.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 30–54, 1933. [Japanese, with English summary.]

In a series of controlled experiments to determine the influence of soil temperature on the occurrence of rice blast [*Piricularia oryzae*: *R.A.M.*, xii, p. 784], the minimum number of diseased seedlings developed at 28° C. and the maximum at 20°, the lowest temperature tested. Hence the susceptibility of the seedlings to blast is least when they are grown at or near the optimum temperature for their development (28° to 32°), and increases proportionately in cooler soils. The lower the soil temperatures, the more severe was the foot rot of seedlings resulting from inoculation with *P. oryzae*. At low temperatures the host tissues remain longer undifferentiated, on account of a slowing down of the growth processes, and this effect of low temperature on the host may be important in increasing the severity of infection even at temperatures below the optimum for the fungus.

KONISHI (S.). **On physiologic specialization in the Rice blast fungus, Piricularia oryzae Br. et Cav.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 55–57, 1 pl., 1 diag., 4 graphs, 1933. [Japanese, with English summary.]

The writer has found that the rice blast fungus, *Piricularia oryzae* [see preceding and next abstracts], consists of a number of physiologic forms distinguishable by their appearance on potato-saccharose (1 per cent.) agar and extent of mycelial growth at different temperatures [*R.A.M.*, xi, p. 538]. The cultural characters by which the forms may be separated include coloration of the submerged mycelium, formation of aerial hyphae, and amount of sporulation. As regards temperature relations, judged by the diameter of the colonies on potato-saccharose or rice straw decoction agar, the physiologic forms of *P. oryzae* fall into at least three groups, the third and largest of which comprises the strains making good mycelial growth at 32° C. Certain strains are unable to develop at 36° while others develop freely at that temperature. Strain No. 18 (Sasaki's Ehime B) and a similar one, both originating in mountain valleys with high humidity and relatively little sunshine, are more highly specialized than the other physiologic forms both in respect of temperature relations and cultural characters. Saltation was observed in pure culture. The physiologic forms were found to differ in their pathogenicity to rice seedlings. No resemblance to *P. zingiberi* or *P. grisea* [ibid., xii, p. 395] was shown by the forms of *P. oryzae* studied.

SUZUKI (H.). **On the relation of soil moisture to the development of the Rice blast disease, with special reference to the results of inoculation experiments on the resistant and susceptible varieties of the paddy Rice and the upland Rice.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 78–97, 1933. [Japanese, with English summary.]

Continuing Hemmi's investigations on the relation of soil moisture to the incidence of rice blast (*Piricularia oryzae*) [*R.A.M.*, x, p. 536 and preceding abstracts], but using a larger number of varieties including both upland and paddy types, the author confirmed Hemmi's conclusions that the more humid the soil on which the plants grow or the longer it remains damp the greater is their resistance to the disease.

ABE (T.). **On the relationship of atmospheric humidity to the infection of the Rice plant by Piricularia oryzae B. et C.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 98–124, 1933. [Japanese, with English summary.]

In order to determine the connexion between relative atmospheric humidity and the infection of rice by *Piricularia oryzae* [see preceding abstracts], seedlings grown in water cultures were inoculated with a spore suspension of the fungus and kept in desiccators adjusted by various concentrations of sulphuric acid to 90, 92, and 100 per cent. relative humidities for 24 hours at 24° to 25° C., when they were transferred to a greenhouse bench. At the end of a week all the inoculated seedlings kept for 24 hours at 92 and

100 per cent. showed the typical blast symptoms, while those at 90 per cent. were quite healthy.

Slides bearing drops of a spore suspension of *P. oryzae* dried naturally at room temperature were kept for 24 hours at 24° to 25° in Petri dishes at 92 and 96 per cent. relative humidity. Slight germination occurred on the slides kept at 96, but none on those at 92 per cent. Similar results were obtained with *Peronospora spinaciae* [*R.A.M.*, viii, p. 626]. Fairly good germination of *Piricularia oryzae* in direct contact with water in Petri dishes was obtained at 96 per cent. relative air humidity, but none at 92 per cent. Thus the limit of relative humidity for the germination of the rice blast fungus is almost the same when the spores are wet as when they are dry. A few of the rapidly germinating spores of *Peronospora spinaciae* developed when similarly in contact with water at a relative air humidity as low as 89 per cent. From the results of these tests it may reasonably be concluded that no blast infection of rice seedlings occurs at relative humidities below 90 per cent. owing to the incapacity of the spores for germination under such conditions.

Suzuki (H.). **On the relation of soil moisture to the development of the blast disease of Rice plant, with special reference to the results of inoculation experiments on seedlings and pedicels of spikes of plants grown on soils differing in the time and duration of drying and irrigation.**—*Forsch. auf dem Geb. der Pflanzenkrank.*, [Kyoto], ii, pp. 172–185, 1 diag., 1933. [Japanese, with English summary.]

The susceptibility of rice seedlings to blast [*Piricularia oryzae*: see preceding and next abstracts] was found to be greatest in a plot where the soil was left continuously dry throughout the growing period, followed by that in one left dry for the first half of the season and irrigated during the last. Next in the decreasing order of infection came a plot irrigated during the first half of the growing period and left dry for the second, the lowest figure for infection being given by a plot irrigated throughout the time of vegetation. The influence of drought on the susceptibility of the seedlings is evidently at its height in the juvenile phase. The spike pedicels were shown by inoculation experiments to be susceptible to blast throughout the growing period, especially before flowering. As in the seedling inoculation tests, the maximum amount of infection occurred in the plot left dry during the entire growing period and the minimum in that continuously irrigated. A correlation was detected between the incidence of blast and the thickness of the outer epidermal cell walls, corresponding to the amount of silica contained in them.

Abe (T.). **On the influence of iron sulphate upon the growth and vitality of Piricularia oryzae, with special reference to temperature as an environmental factor.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 186–201, 1933. [Japanese, with English summary.]

At 28° C., the optimum temperature for the growth of a strain

of the rice blast fungus (*Piricularia oryzae*) [see preceding and next abstracts], mycelial development was stimulated by the addition of 1/1,000 mol. iron sulphate to a potato decoction agar medium containing 1 per cent. sucrose, no such effect being noticeable, however, at other temperatures. On a liquid medium the mycelium grew best at 24°, but the liquid cultures differed from the solid in that the presence of 1/1,000 mol. iron sulphate stimulated growth at all temperatures from 16° to 32°. No mycelial growth took place on agar containing 1/50 mol. iron sulphate between 16° and 32°, but development occurred in the presence of 1/100 mol. or less at all temperatures except 32°. The corresponding figures on the liquid medium were 1/200 and 1/400 mol. respectively. At all the temperatures tested, conidial formation was retarded in inverse proportion to the concentration of iron sulphate added to the agar medium, being practically nil at concentrations above 1/200 mol. Chlamydospore production, on the other hand, showed a tendency to increase gradually with the increment of iron sulphate. No aerial mycelium developed on a medium containing over 1/200 mol. iron sulphate at any of the temperatures tested. The hyphae became very nodular in the presence of high concentrations of iron sulphate, which also turned the colour of the colonies from greyish-white to sooty green or greenish-yellow.

Suzuki (H.). **On the relation of soil moisture to the development of the blast disease of Rice, with special reference to the inoculation experiments on plants grown on soils differing in moisture and amount of nitrogenous manure.**—*Forsch. auf dem Geb. der Pflanzenkrankh.*, [Kyoto], ii, pp. 279–291, 1933. [Japanese, with English summary.]

The results of inoculation experiments with *Piricularia oryzae* [see preceding abstracts] on rice seedlings and the spike pedicels of plants grown on soils varying in moisture content and nitrogenous fertilization showed that the susceptibility of the plants to blast was primarily dependent on the former factor. The seedlings, adult leaves, and spike pedicels grown on flooded soil with a certain amount of nitrogenous manure were more resistant to infection than those on dry soil with half the quantity of the same manure, this reaction being apparently correlated with a more extensive accumulation of silica in the epidermal cell-walls of the leaves of plants developing under the former conditions.

Airplane for Hop dusting.—*Better Fruit*, xxviii, 3, p. 13, 1933.

An aeroplane is being used in the control of hop downy mildew [*Pseudoperonospora humuli*] in the Willamette Valley, Oregon, the machine blowing a copper-lime dust mixture on to the plants and descending as low as 5 to 15 ft. from the ground to do so. The dust is carried in a specially constructed compartment in front of the cockpit and is scattered by the air currents set up by the propeller and two small propeller agitators. *P. humuli* has recently made startling headway in the locality concerned [cf. *R.A.M.*, xii, p. 325].

McRae (W.) & Subramaniam (L. S.). **Effect of mosaic on the tonnage and the juice of Sugar cane in Pusa, Part III.**— *Indian Journ. Agric. Sci.*, iii, 5, pp. 870–880, 1933.

During the season 1932–3 about 4 per cent. less juice was extracted from mosaic-infected than from healthy canes in 16 pairs of experimental plots [*R.A.M.*, xiii, p. 11]. Similar results were obtained in previous seasons' tests. There was slightly less glucose in the mosaic than in the healthy juice, but in other respects the differences between the two lots of plants were not statistically significant.

Ciferri (R.). **Le concept d'espèce dans les microorganismes parasites.** [The concept of species in parasitic micro-organisms.] —*Scientia, August, 1933*, pp. 63–72; *September, 1933*, pp. 83–91, 1933.

After defining the terms 'systematic', 'classification', 'taxonomy', and 'determination' and discussing current views on the reality of species, the author sums up the present situation as regards the limitation and interpretation of taxonomic unity (especially specific unity) in the higher plants with special reference to the confusion resulting from the extension of these concepts to the lower ones, and reviews the characteristics distinguishing taxonomic units in parasitic and saprophytic micro-organisms. He outlines the development of the classification of the bacteria and yeasts, and illustrates the nature of the problem by two queries: (1) should the biological interpretation of taxonomic unity be accepted?, and (2) should taxonomic units based on biological characters rank as species or as something lower, and if so, as what?

To adopt a taxonomy that ignores the biological characters of parasitic organisms and takes cognizance only of their shape is considered to be like trying to distinguish minerals while disregarding their chemical composition. The return to a purely morphological taxonomy appears to be impossible in the light of modern knowledge of biological specificity; taxonomy should be adapted to include all recognizable characters, whatever their nature.

Granted that the biological characters of a micro-organism may be accepted as differentiating taxonomic entities, the question arises what rank or ranks shall be assigned to them?

The best solution, the author thinks, would be to adopt the trinomial nomenclature, in which case the units below specific rank would include those distinguished by all non-macromorphological characteristics. This system would not consider whether a subspecific unit is distinguishable by any particular criterion, but would merely indicate that such a unit is distinct, the description alone giving the reasons. Further, it would maintain a relative homogeneity of species, in the classical sense, one comprehensive unit with ample morphological characteristics being established. If such a nomenclature were adopted a Commission would have to be appointed to determine the morphological species for each Order of fungi and bacteria, and to group around them the secondary units.

STEVENS (F. L.) & PEIRCE (A. S.). **Fungi from Bombay.**—*Indian Journ. Agric. Sci.*, iii, 5, pp. 912–916, 1933.

An annotated list is given of 40 fungi, including eight new species [with English diagnoses], collected by B. N. Uppal in Bombay, of which the following may be mentioned. *Physalospora psidii* n.sp. occurs on guava (*Psidium guajava*) and is characterized by an intercellular, brown mycelium, continuous, elliptical, hyaline microconidia, 5 to 7 by 2 to 3 μ, and similar macroconidia, 12 to 15 by 5 to 8 μ, borne on conidiophores 10 to 13 μ long; scattered, astromatic, immersed subglobose perithecia, with a short protruding, ostiolate beak, 120 to 165 μ in height, 270 to 345 μ in breadth, paraphysate, clavate asci, 72 to 100 by 26 to 33 μ, tapering at the base, and containing 8 elliptical, hyaline ascospores, 30 to 37 by 13 to 16 μ.

Oidium cococarpum n.sp., distinguishable by its scanty, branched, septate mycelium, suberect to erect, short, septate or continuous conidiophores, and hyaline, ellipsoid, concatenate conidia, 8 to 10 by 6 to 8 μ, was observed on coco-nut seed.

Gloeosporium raciborskii occurred on mango and *Myxosporium microsporum* Cooke and Hark. on apple.

VIENNOT-BOURGIN (G.). **Contribution à l'étude des Urédinales de Seine-et-Oise (6me Note). De quelques Urédinales rares ou nouvelles observées dans le département de Seine-et-Oise.** [Contribution to the study of the Uredinales of Seine-et-Oise. (6th note.) On a few rare or new Uredinales observed in the Department of Seine-et-Oise.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 8, pp. 280–289, 1 pl., 1 map, 1933.

This further annotated list of four rusts observed by the author in the Seine-et-Oise Department [*R.A.M.*, xii, p. 537] includes a species of *Gymnosporangium* which was seen in the spring of 1933 on branch swellings of *Juniperus sinensis* in the arboretum of the Agricultural School at Grignon, the teleutospores of which markedly differed from those of the species met with on the junipers commonly cultivated in France. The aecidial stage was found in the summer of that year on *Pyrus sinensis* L. growing at about 50 m. distance from the junipers, and had already been observed in the two preceding years on *P. sinensis*, developing earlier in the season than that usually occurring on pear in the locality. It could not be identified before the discovery of the *Gymnosporangium* on *J. sinensis*, which agrees morphologically with Sydow's description of *G. japonicum*.

A heavy outbreak of *Antirrhinum majus* rust (*Puccinia antirrhini*) occurred during the summer of 1933 at Grignon, especially on the semi-dwarf and dwarf varieties of snapdragons. The rust had already been seen in 1931, but spread to an epidemic extent only in 1933, apparently from two-year-old plants on which it overwintered in the teleutospore stage. Observations indicated that unicoloured varieties (pure red or pure yellow) of *Antirrhinum* are more susceptible than those with variegated flowers. The rust appears to be widespread through the north-west region of France, and has also been reported recently from Great Britain [ibid., xii, p. 764].

Overholts (L. O.). **The Polyporaceae of Pennsylvania. I. The genus Polyporus.**—*Pennsylvania Agric. Exper. Stat. Bull.* 298, 28 pp., 2 pl., 1933.

In this paper (the subject-matter of which is to be more fully dealt with in a manual covering the Polyporaceae of the United States) the author, after discussing the economic importance of the group and describing the structure of the sporophore and hymenium, gives keys to the 12 genera of Polyporaceae found in Pennsylvania and to the species of *Polyporus* [including *Polystictus*] present in the State. A resumé is then given of the main characters of 90 individual species and varieties.

Wehmeyer (L. E.). **The genus Diaporthe Nitschke and its segregates.**—xi + 349 pp., 18 pl., Ann Arbor, Univ. of Michigan Press, 1933.

In this elaborate monograph the author publishes a revision of some 500 of the 650 nominal species of *Diaporthe* [cf. *R.A.M.*, xii, p. 595]. His material consisted of the published and private exsiccata maintained in the Farlow Herbarium, together with numerous collections loaned from other sources.

Diaporthe is held to be characterized among the neighbouring genera by the presence of black lines in the host, 2-celled ascospores, and *Phomopsis* pycnidia. In this genus, 71 species are accepted on purely morphological grounds, but 'the classification, synonymy and descriptions of species of the genera here considered are in an unsettled and scarcely dependable state'. The consideration of the first 9 of the accepted species involved the investigation of some 380 collections; that of *D. eres* [ibid., xii, p. 126], the investigation of some 417 collections, under 137 specific names, on 68 genera of woody plants.

Revised descriptions of the accepted species are given, having reference to the stromata, their relation to the host plant, the perithecia, asci, and spores, e.g., the characters to which standard diagnoses uniformly refer. A critical survey of the pycnidial stages is not attempted: their 'confusing similarity makes such a study a difficult, separate problem'.

Of the names with a pathological history, *D. sojae* on soy-beans [ibid., ix, pp. 23, 83] is renamed *D. phaseolorum* var. *sojae*, and *D. batatatis* on sweet potato *D. phaseolorum* var. *batatatis* [ibid., xi, p. 535]. On *Citrus*, *D. citrincola* and *D. citri* [ibid., xiii, p. 26] together with *P. citri* and *P. californica* [ibid., xii, p. 213] are considered host forms of *D. medusaea*. *D. perniciosa* [ibid., xii, p. 677; xiii, p. 107] is listed as a synonym of *D. eres*. Among the excluded species, *D. rostellata* on *Rubus* is held to be a *Gnomonia*, and *D. umbrina* on rose [ibid., xii, p. 696] a primitive type of the genus *Cryptosporella*.

The published diagnoses of some 150 species, of which no material was available to the author, are given mainly without comment. The segregate genera are *Cryptodiaporthe* (with 19 species), *Diaporthella* (3 species), *Apioporthe* (8 species), and *Diaporthopsis* (8 species).

Keys are given to the accepted species of each genus, and the host plants are mentioned after such species as are not too pluri-

vorous. There is a full index of fungus names, and upwards of 90 species are illustrated to show the habit of the fungus, together with the ascospores and occasionally the pycnospores.

MATSUMOTO (T.), YAMAMOTO (W.), & HIRANE (S.). **Physiology and parasitism of the fungi generally referred to as Hypochnus sasakii Shirai. II. Temperature and humidity relations.**— *Journ. Soc. Trop. Agric.*, Formosa, v, pp. 332–345, 4 figs., 1 graph, 1933.

Further experiments were carried out under controlled conditions to determine the temperature and humidity relations of the 17 Formosan strains of *Hypochnus* [*Corticium*] *sasakii* previously studied in respect of cultural behaviour and hyphal fusion [*R.A.M.*, xii, p. 331], with the addition of one isolated by M. Mitra at Pusa, India, from 'banded sclerotial disease' of sugar-cane [ibid., xi, p. 432].

In general the grouping of the strains in respect of temperature agrees fairly closely with that based on differential cultural characters and mode of hyphal fusion. The optimum temperature for all the Formosan strains lies between 28° and 31° C., probably near the lower limit, with an estimated minimum and maximum of 13° and 37°, respectively. The temperature requirements of *Rhizoctonia* [*C.*] *solani* strain No. 19 [loc. cit.], the agent of black scurf of potato in Germany, were found to be quite different from those of *C. sasakii*, whereas the Indian strain No. 18 [loc. cit.] of the latter from cotton seedlings approximated closely to the Formosan isolations in this respect. Both in cultural characters and temperature relations the causal organism of 'banded sclerotial disease' of sugar-cane from India was also found to agree closely with the strains collectively known as *C. sasakii* in Formosa. Heavy infection of *Eichhornia crassipes* by strain 1 [from rice] took place at 28°, the minimum and maximum for infection being 16° and 34°, respectively, while the highest incidence of infection occurred at 100 per cent. relative humidity, gradually decreasing in proportion to the decline in the moisture content to about 85 to 88 per cent., below which negative results were obtained.

MATSUMOTO (T.) & HIRANE (S.). **Physiology and parasitism of the fungi generally referred to as Hypochnus sasakii Shirai. III. Histological studies in the infection by the fungus.**— *Journ. Soc. Trop. Agric.*, Formosa, v, pp. 367–373, 3 figs., 1933.

Further inoculation experiments were carried out on camphor (*Cinnamomum camphora*), tobacco, and *Eichhornia crassipes* with a strain of *Hypochnus* [*Corticium*] *sasakii* from rice [see preceding abstract] in order to determine the mode of infection and histological changes induced by the fungus.

The discoloration of the tissues was found to extend some distance beyond the cells actually invaded by the hyphae, especially in the palisade tissue of young camphor leaves, which is composed of thin-walled cells with few intercellular spaces. In *E. crassipes*, the leaf tissues of which are well provided with intercellular spaces, the hyphae are frequently found outside the necrotic area. It

would appear that the tissue discoloration is due to a diffusible product of the fungal metabolism, readily permeable through the cell walls of young parenchyma, especially when the cells are densely packed without intercellular spaces. On leaves kept under dry conditions the spread of the lesions is arrested, and this results in the development of a dark marginal zone with a yellowish halo. The tissues near the halo contain few chloroplasts. The hyphae generally enter the plant through the stomata, though in the early stages of leaf development they may be able to penetrate directly through the cuticle. Cell wall penetration is mainly accomplished by the cellulose-dissolving action of the invading hyphae. The accumulation of starch in the necrotic area points to a disturbance of translocation consequent on infection.

PALM (B. T.). **On parasitic and epiphyllous algae. II. Stomatochroon, a genus of stomaticolous Chroolepideae.**—*Arkiv för Bot.*, xxv A, 16, pp. 1–16, 5 figs., 1933.

Stomatochroon lagerheimii n. g., n. sp., a Chroolepidean alga found occupying the stomata of the upper leaf surfaces of *Chlorodendron* sp. at Medan, Sumatra, is characterized by a cylindrical central thallus cell lying between the guard cells of the stoma, slightly tapering towards the base to which is affixed in the substomatal chamber a bulbous anchor cell with an extensively lobate base. From the free end of the central cell a single sporangiophore ordinarily grows out and bears one apical zoosporangium on a neck cell. Sterile filaments also radiate upwards from the central cell. Thick-walled, smooth, resting sporangia develop around the extramatrical half of the central cell usually to the number of two or three; these may possibly be gametangia, but the zoospores were not further studied. All the aerial parts are of a deep purple colour, the basal cell being vivid green. The haustorium-like shape of the basal cell strongly indicates a physiological rather than a purely mechanical relationship between the alga and its host, but so far no evidence of food transference has been obtained. Other hosts of *Stomatochroon* spp. include wild banana 600 m. above sea level in Sumatra, *Crotalaria usaramoensis* and teak (*Tectona grandis*) also in Sumatra, and *Artocarpus incisa*, avocado, *Anacardium occidentale*, and tomato in Guatemala.

BOSSCHIETER (J. C. A.). **Werkmethoden in verband met Helopeltis en Redrust.** [Methods of cultivation in connexion with *Helopeltis* and red rust.]—*De Bergcultures*, vii, 46, pp. 1261–1263, 1933.

Much of the damage caused by *Helopeltis* and red rust [*Cephaleuros parasiticus*: *R.A.M.*, x, pp. 345, 760, and above, p. 216] on Java tea estates, in some of which they have become rather prevalent of late, may be prevented by rational methods of shade provision, proper drainage, and a conservative scheme of plucking and pruning to avoid sudden drastic changes in the condition of the bushes. Details are given of successful results in reducing the injury from mosquito blight and red rust by these means in a plantation in West Java.